

3200B VHF OSCILLATOR

OPERATING AND SERVICE MANUAL



HEWLETT  PACKARD



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OPERATING AND SERVICE MANUAL

MODEL 3200B VHF OSCILLATOR

SERIALS PREFIXED: 626

This manual applies directly to Model 3200B VHF Oscillators having serial prefix 626. This manual with changes provided in Appendix 1 applies to Models having prefix numbers 534, 604, 622. (See paragraph 1-10).

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Green Pond Road

Rockaway, New Jersey, U. S. A.

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Frequency range: 10 to 500 MHz in six bands: 10 to 18.8 MHz; 18.5 to 35 MHz; 35 to 68 MHz; 68 to 130 MHz; 130 to 260 MHz; 260 to 500 MHz.

Frequency accuracy: within $\pm 2\%$ after $\frac{1}{2}$ hour warmup.

Frequency calibration: increments of less than 4%.

Frequency stability (after 4-hour warmup under 0.2 mw load): short term (5 minutes) $\pm 0.002\%$; long term (1 hour) $\pm 0.02\%$; line voltage (5-volt change) $\pm 0.001\%$.

RF output:

Maximum power (across 50-ohm external load):
>200 mw (10 to 130 MHz); >150 mw (130 to 260 MHz); >25 mw (260 to 500 MHz).

Range: 0 to >120 db attenuation from maximum output.

Load impedance: 50 ohms nominal.

RF leakage: sufficiently low to permit measurements at 1 μ v. **RFI:** meets requirements of MIL-I-6181D.

Amplitude modulation: externally modulated.

Range: 0 to 30%.

Distortion: <1% at 30% AM.

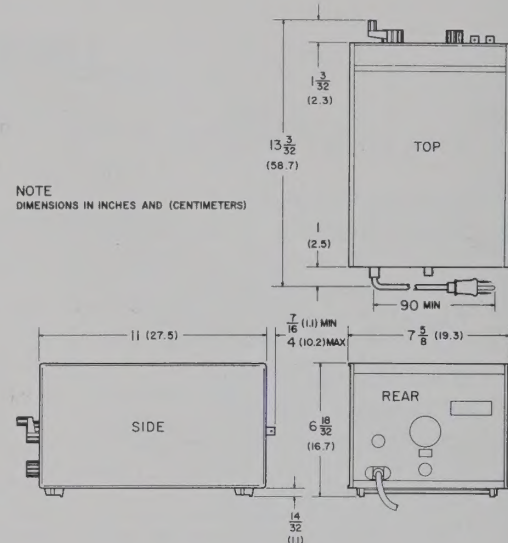
External requirements: approximately 20 volts rms into 600 ohms for 30% AM, 200 Hz to 100 kHz.

Pulse modulation: externally modulated.

External requirements: 2.5 volt negative pulse into 2000 ohms.

Power: 105 to 125 v or 210 to 250 v, 50 to 1000 Hz, 30 w.

Dimensions:



Weight: net 15 lbs. (6,8 kg), shipping 19 lbs. (8,6 kg).

Accessories available: 13515A Frequency Doubler Probe; 00501B, 00514B, 00517B Output Cables; 00502B, 00506B Patching Cables.

Table 1-1. Specifications

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The 3200B VHF Oscillator is designed for general purpose laboratory use in the frequency range of 10 to 500 MHz. Typical applications include: receiver and amplifier testing; driving bridges, slotted lines, antenna and filter networks; and use as a local oscillator for heterodyne detector systems.

1-3. The push-pull oscillator is housed in a rugged aluminum casting for maximum stability and extremely low leakage. Six frequency ranges are provided for adequate bandspread on the slide-rule dial. Amplitude and pulse modulation may be obtained by the use of suitable external sources.

1-4. The RF output is coupled through a waveguide-below-cutoff variable attenuator. An electronic RF level vernier is included as a front panel control.

1-5. A solid-state power supply furnishes all necessary operating voltages, including dc, to the oscillator tube heaters for minimum hum modulation and maximum tube life.

1-6. The VHF Oscillator is completely self-con-

tained and housed in a modular cabinet which can be adapted, using a combining case or rack adapter frame, for standard rack mounting.

1-7. SUPPLEMENTARY EQUIPMENT.

1-8. The -hp- 13515A frequency doubler probe will extend the frequency range of the 3200B up to 1000 MHz. In the frequency range from 500 to 1000 MHz, the power output will be in excess of 4 mw across an external 50 ohm load.

1-9. INSTRUMENT IDENTIFICATION.

1-10. Hewlett-Packard uses a two-section, eight-digit serial number (on instrument rear panel) to identify instruments (000-00000). The first three digits are a serial prefix number, and the last five digits refer to a specific instrument. If the serial prefix on your instrument does not appear on the title page of this manual, there are differences between the manual and your instrument which are described in the Appendix or in a Manual Change Sheet included with the manual. If the change sheet is missing, the information can be supplied by your local sales office.



Fig. 1-1. Model 3200B VHF Oscillator

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, repacking and installation.

2-3. UNPACKING AND INSPECTION.

2-4. Inspect instrument for shipping damage as soon as it is unpacked. Check for broken knobs and connectors; inspect cabinet and panel surfaces for dents and scratches. If instrument is damaged in any way or fails to operate properly, notify carrier immediately (see warranty statement on the inside front cover of this manual). For assistance of any kind, including help with instruments under warranty, contact your Hewlett-Packard field office.

2-5. INSTALLATION.

2-6. This instrument may be rack mounted after installation in a combining case (-hp- 1052A) or a rack adapter frame (-hp- 5060-0797). The area not used by the instrument, in either case, may be covered by a filler panel (-hp- 5060-0794). When rack mounting this instrument, special provision must be made for access to the output connector and attenuator adjustment which are on the rear panel of the instrument.

2-7. Connect the power cord to the power socket on the rear panel of the 3200B.

2-8. VENTILATION.

2-9. The 3200B utilizes both tubes and semiconductors. Heat is dissipated through conduction and radiation from the large metal pieces which act as heat sinks. This instrument has been tested to operate satisfactorily with ambient temperatures up to 55° C (131° F). Ventilation should be provided to avoid exceeding this temperature.

2-10. POWER REQUIREMENTS.

2-11. The model 3200B can be operated from a 115 or 230 v, 50 to 1000 Hz source. An input voltage switch (115v-230v) at the rear of the instrument selects the AC operation mode. A 1/2 AMP, SLO-BLO, fuse in the AC line is used for 115 v operation, 1/4 AMP, SLO-BLO 230 v operation.

2-12. THREE-CONDUCTOR POWER CABLE

2-13. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument panel and cabinet be grounded. All Hewlett-Packard instruments are equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instruments. The offset pin on the power cable three-prong connector is the ground wire.

2-14. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green pigtail on the adapter to ground.

2-15. REPACKAGING FOR SHIPMENT.

2-16. The following is a general guide for repacking for shipment. If you have any questions, contact your local -hp- Sales and Service Office (see lists at rear of this manual).

a. Place instrument in original container if available. If original container is not available, it can be purchased from your nearest -hp- Sales and Service Office.

If original container is not used:

b. Wrap instrument in heavy paper or plastic before placing in an inner container.

c. Use plenty of packing material around all sides of instrument and protect panel faces with cardboard strips.

d. Place instrument and inner container in a heavy carton or wooden box and seal with strong tape or metal bands.

e. Mark shipping container with "Delicate Instrument", "Fragile", etc.

NOTE: If the instrument is to be shipped to Hewlett-Packard for service or repair, attach to the instrument a tag identifying the owner and indicate the service or repair to be accomplished; include the model number and serial number of the instrument. In any correspondence, identify the model and serial numbers.

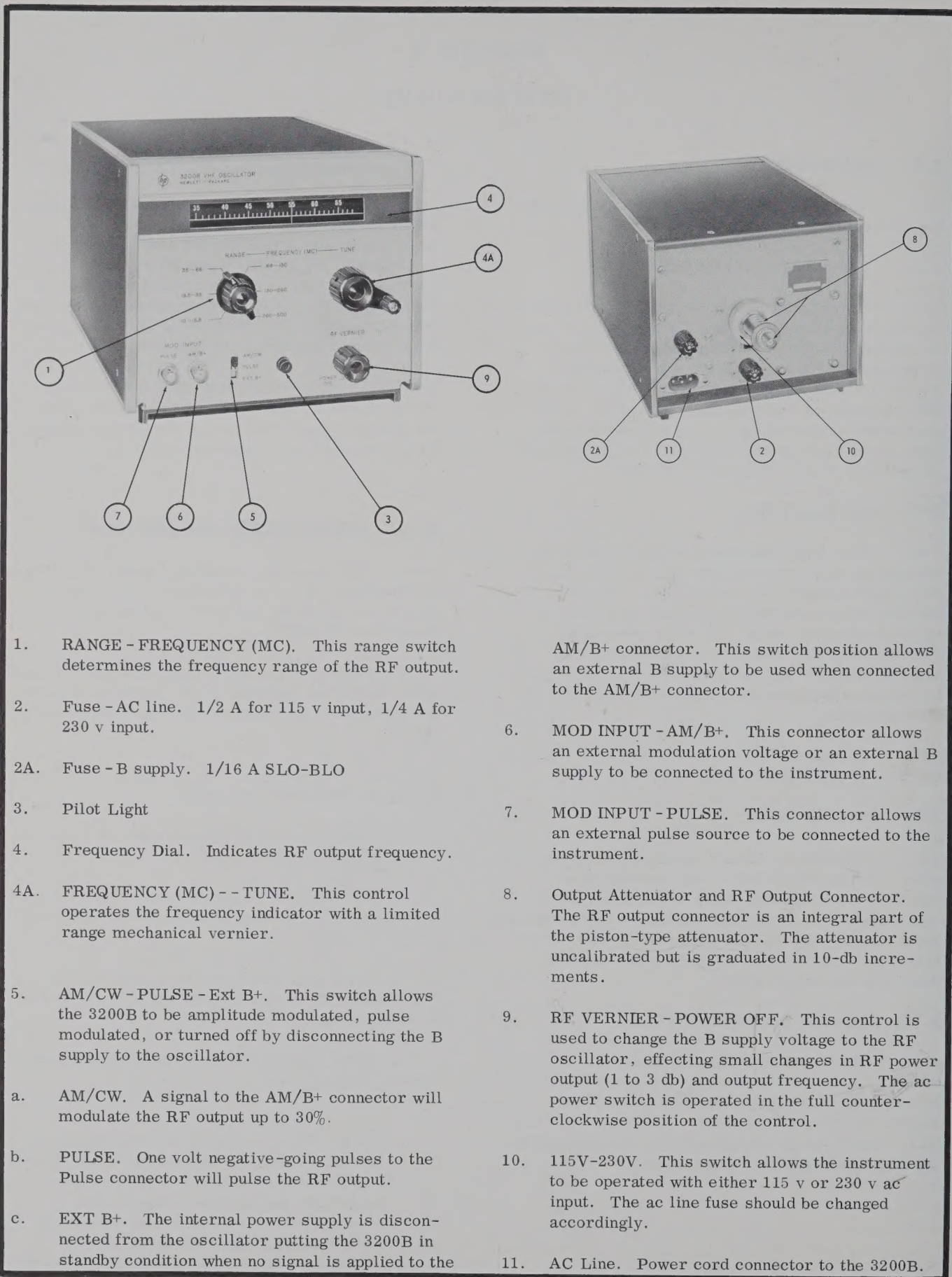


Fig. 3-1. Operating Controls and Layout

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. The 3200B VHF oscillator provides a convenient source of RF power over the frequency range of 10 to 500 MHz in six bands. Power output is in excess of 25 mw (across 50 ohm load) or 1.1 v on all bands. Below 260 MHz, the power output is in excess of 150 mw (across 50 ohm load) or 2.7 v. Below 130 mc, the power output is in excess of 200 mw (across 50 ohm load) or 3.1 v.

3-3. The output attenuator will provide greater than 120 db attenuation from the maximum output at any frequency setting.

CAUTION: When setting the attenuator, the probe must not be completely inserted in the tube while the instrument is operated at the low frequency end of the 260 to 500 MHz range. The loading on the oscillator by the attenuator could cause the oscillator to stop. In this condition, the tubes will draw excessive current causing the B supply fuse (2A) to open.

3-4. CONTROLS AND INDICATORS.

3-5. Front and rear panel controls, indicators, and connectors are shown in Fig. 3-1. Each control, indicator, and connector is identified by a number to key each to the identifying text below the photographs.

3-6. OPERATING PROCEDURES.

3-7. With power connected to the 3200B (See par. 2-11 for power requirements), rotate the power switch and RF vernier (9) to maximum clockwise position. This is the maximum output position for the control. The output from the 3200B is useable in less than 1 minute, but for specified stabilities, it should warm up 4 hours.

3-8. USING THE OSCILLATOR.

3-9. OUTPUT ATTENUATOR.

3-10. The output level from the 3200B is controlled by a piston attenuator. The attenuator probe is graduated in twelve 10-db steps with no absolute values shown. The probe may be locked in any position along its length by the slight rotation of the spring-loaded, knurled, locking ring on the attenuator. There is no stop on the attenuator probe allowing complete withdrawal from the tube, so care should be taken to avoid damage.

CAUTION: When setting the attenuator, the probe must not be completely inserted in the tube while the instrument is operated at the low frequency end of the 260 to 500 MHz range. The loading on the oscillator by the attenuator could cause the oscillator to stop. In this condition, the tubes will draw excessive current causing the B supply fuse (2A) to open.

3-11. MODULATION INPUTS.

3-12. The 3200B has two modulation input connectors and three positions of the input voltage switch. Modulating frequencies over the range of 200 Hz to 100 KHz can be used with this instrument. With proper combinations of input connections, switch positions, and available signal amplitudes; sine wave or complex signals, positive-going pulses, and negative-going pulses may be used to modulate the 3200B. However, the 3200B is a CW source, so the instructions, which follow, are for the simple recommended modes of operation:

3-13. AMPLITUDE MODULATION.

Modulation Switch position - AM/CW

Input connector used - AM/B+

Signal Requirement - 200 Hz to 100 kHz into 600 ohms

Output Signal - Modulated RF; approximately 20 v rms will result in 30% AM with less than 1% distortion. (RF VERNIER control full counterclockwise position)

CAUTION: With the modulation input switch in the AM/CW or Ext B+ position, no resistance of less than 1000 ohms should be connected across the PULSE input connector. A low resistance across the PULSE input connector will change the -6 v bias to the pulse modulation (Z400) circuit, sufficiently, to reduce or stop the RF oscillator output.

3-14. PULSE MODULATION.

Modulation Switch position - PULSE

Input connector used - PULSE

Signal requirement - up to 2.5 v peak amplitude negative-going pulses

Output signal - Pulsed RF

NOTE: In this mode of operation the RF oscillator is shut off between pulses, thus the on-off ratio for pulse modulation is very high.

3-15. EXTERNAL B+ OPERATION.

Modulation Switch position - EXT B+

Input connector used - AM/B+

Signal requirement - B+ supply with a maximum voltage of 135 volts and a current capacity of up to 40 ma.

Output signal: CW - Output level dependent on dc voltage and attenuator probe setting

CAUTION: With the modulation input switch in the AM/CW or EXT B+ position, no resistance of less than 1000 ohms should be connected across the PULSE input connector. A low resistance across the PULSE input connector will change the -6 v bias to the pulse modulation (Z400) circuit, sufficiently, to reduce or stop the RF oscillator output.

3-16. OPERATIONAL GUIDE.

3-17. In the practical application of the 3200B, the following information should assist in providing more accurate results as the capabilities and limitations of the instrument are expanded upon.

3-18. OUTPUT LEVEL.

3-19. Operating efficiency in a wide-band oscillator varies across the entire band. Thus, the output power also varies. The typical maximum output over the range of the 3200B is shown in Fig. 3-2. The maximum output into 50 ohms has been determined by observing the output of the 3200B, while adjusting the probe, without regard to probe calibration markings.

3-20. RF DISTORTION.

3-21. The basic oscillator used in the 3200B has two tubes operated in push-pull. In the normal balance condition between the tubes, the push-pull operation suppresses the even-harmonic content of the output waveform. The output of the 3200B is sinusoidal with very low distortion. Using a high frequency sampling oscilloscope (such as the -hp-185B), the RF waveform may be observed directly. The oscilloscope patterns in Fig. 3-3 show the typical output of the 3200B at various frequencies. Fig. 3-3A is the output waveform at 100 MHz. Figs. 3-3B and 3-3C are RF waveforms at 400 MHz and 500 MHz respectively. At the higher frequencies, and at lower output levels, the waveshape departs slightly from sinusoidal as the slope of the curve through the

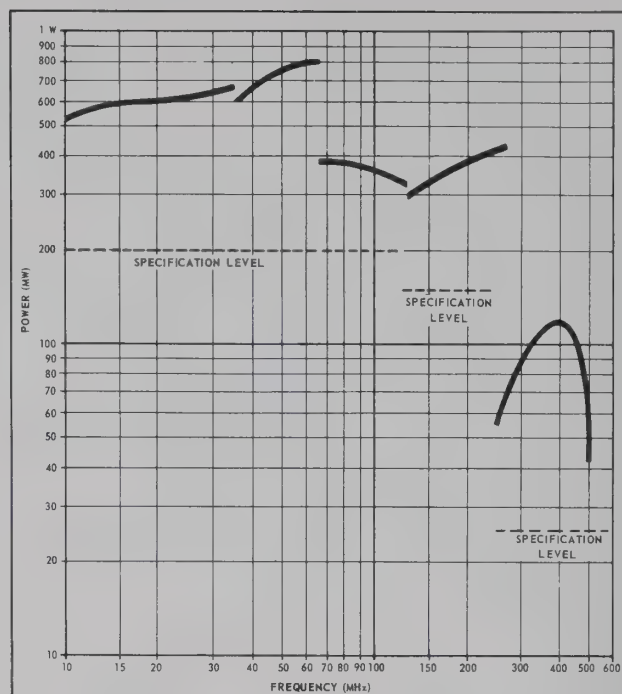


Fig. 3-2. Typical Maximum Power Output

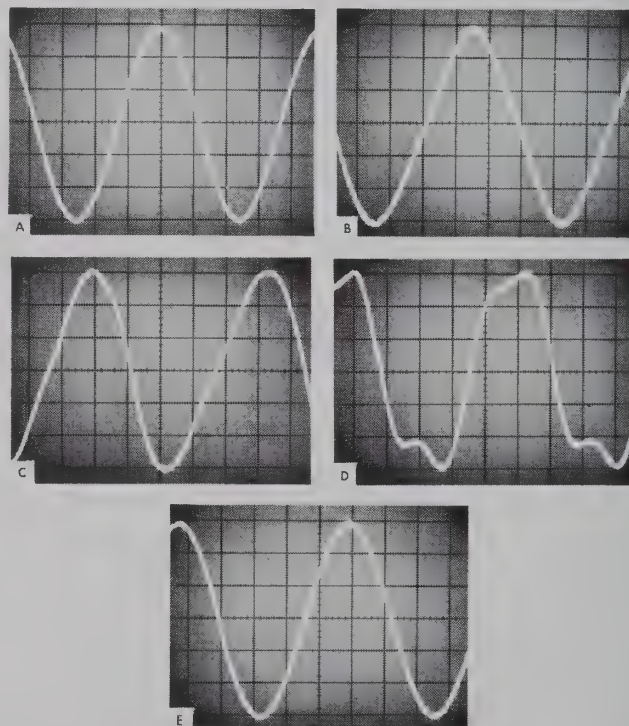


Fig. 3-3. Typical RF Output Waveforms

baseline resembles a straight line. With a very low output level at 460 MHz, even harmonics show up in the waveform as in Fig. 3-3D. This condition is due to the lack of perfect electrical balance between two tube circuits, which is normal, as lead lengths and tube and component characteristics differ slightly. At the higher output levels, and on the high frequency

range, the RF waveshape again resembles the shape shown in Fig. 3-3A. By the use of a low-pass filter, the output waveshape may be restored to its original shape, as in Fig. 3-3E.

3-22. TYPICAL DRIFT.

3-23. The output level of the 3200B is quite stable for long periods of time. However, the frequency will drift slightly. Also, after complete warmup, the frequency stability will change as a result of switching ranges or readjusting the frequency dial. Typical frequency drift (for 5 minutes after a 4-hour warm-up), on the various ranges, is shown in Fig. 3-4. The drift is shown as a percentage of the initial frequency setting.

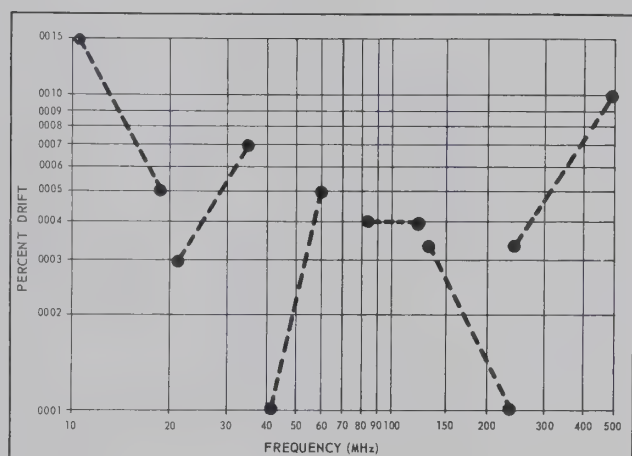


Fig. 3-4. Typical Frequency Drift

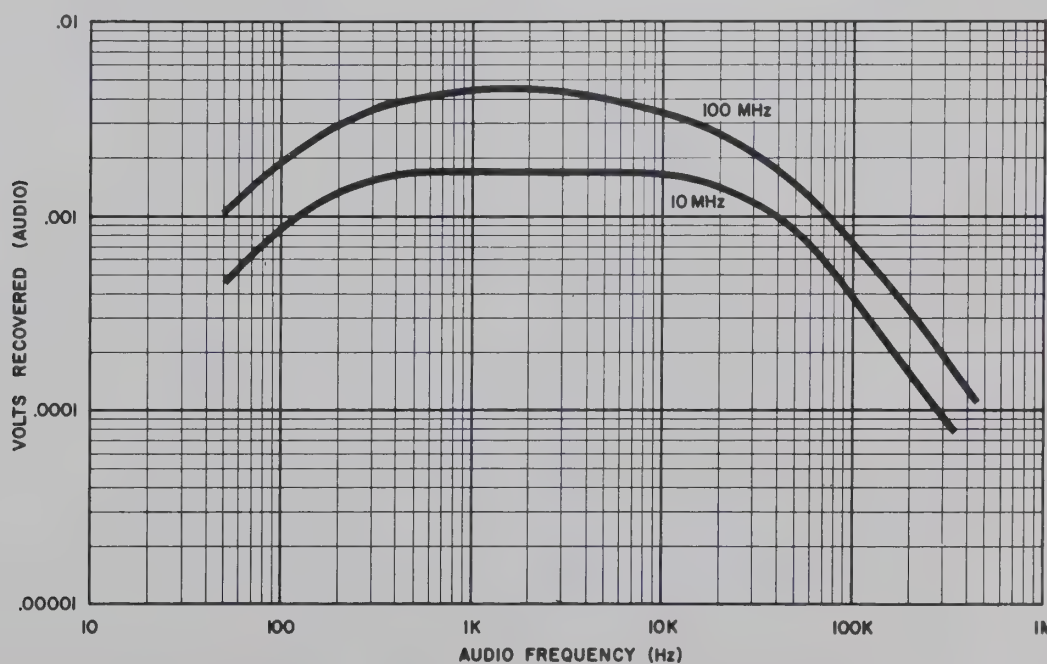


Fig. 3-5. Typical Frequency Response

3-24. FREQUENCY RESPONSE (MODULATION).

3-25. The 3200B is amplitude modulated by capacitively coupling a modulating signal to the Oscillator tube plate voltage supply. The modulated dc is fed, via a low pass filter, into the RF housing. This filter must have a relatively low audio cut-off frequency to prevent RF leakage at the lowest RF frequency of 10 MHz. However, the response is essentially flat across the audio range from 200 Hz to 100 KHz. Fig. 3-5 shows the typical frequency response with RF frequencies of 10 MHz and 100 MHz.

3-26. AMPLITUDE MODULATION.

3-27. The 3200B can be used at higher than 30% AM. The 30% AM at less than 1% distortion (See Specifications--Section II) is a limitation because of lack of external control of the internal power supply. The design of the 3200B is such as to allow operation with an external variable dc supply. Depending on the source used, the audio signal may be transformer or capacitively coupled to the dc supply. This composite ac and dc signal is connected to the AM/B+ connector with the modulation input switch in the EXT B+ position. The only limitation of this method of modulation is that the dc supply voltage plus the rms voltage of the modulation signal must not exceed 135 volts. (This is the tube manufacturer's design maximum.) One hundred percent modulation is possible with this mode of operation. Recovered audio distortion for 90% amplitude modulation with 1 v rms RF output has been found to be typically less than 3% at 10, 20, 40, 80, 150, 250, 400, and 500 MHz.

3-28. It should be noted that the RF output may not meet the specified levels with this system.

SECTION IV

PRINCIPLES OF OPERATION

4-1. GENERAL.

4-2. The 3200B VHF Oscillator, shown in the block diagram (Fig. 4-1), covers the frequency range from 10 to 500 MHz with six overlapping bands. This instrument was designed primarily as a high output source of CW. Circuitry has been incorporated to allow both amplitude and pulse modulation. A variable, piston-type, waveguide-below-cutoff attenuator is used to control the output.

4-3. RF OSCILLATOR.

4-4. The oscillator circuit, shown in Fig. 4-2, generates all of the radio frequencies in the 10 to 500 MHz range of the instrument. The circuit employs two 6DZ4 triodes with push-pull connected plates and grounded cathodes. Simple, fixed feedback is accomplished by means of capacitive dividers consisting of C102 and C104, together with the grid-to-cathode capacitance of the triodes. Chokes L109 and L110, along with good cathode grounding and short grid connections, serve to maintain high grid circuit impedance, preventing phase shift in the feedback voltage divider and consequential oscillation in the circuit at some frequencies.

4-5. Tuning of the oscillator is accomplished by means of a tank circuit which includes coils L101 to L106 and capacitors C103A and C103B. Actually, there are six different tank coils; one for each frequency range. The coils are wrapped on a specially formed turret which is detented into one of six frequency range positions by the Range Switch on the

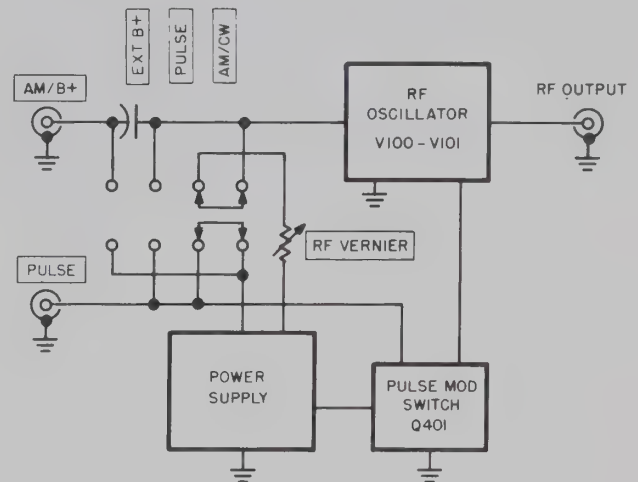


Fig. 4-1. Block Diagram - 3200B

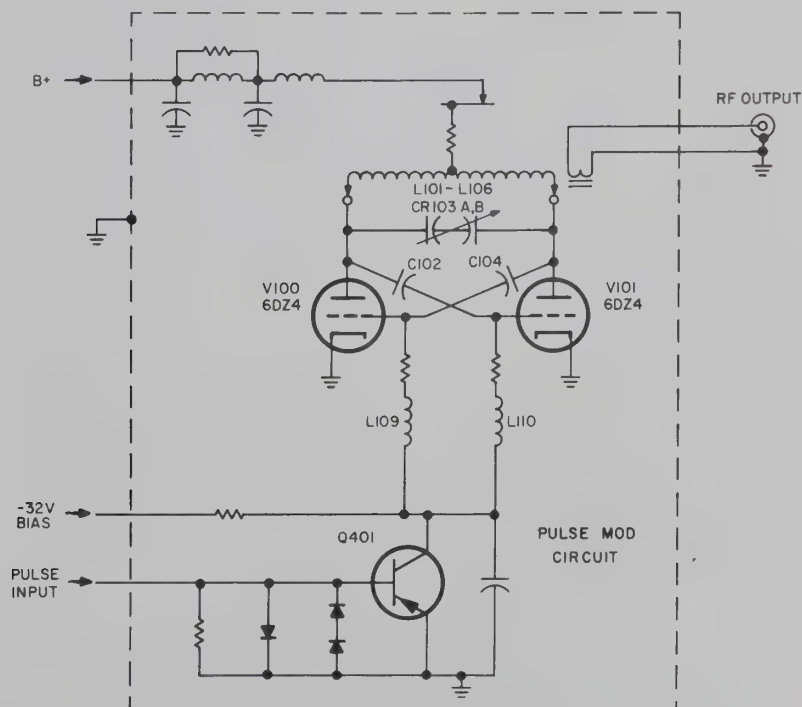


Fig. 4-2. RF Oscillator Circuit

front panel. Wiping contacts are used to connect the selected coil into the tank circuit. The center of each tank coil is neutral and is used as a feed point for plate power, which is connected through a switch operated by the turret drive and a common supply ring on the turret. One hundred ohm resistors (R101 to R106) are connected between the coils and the B+ feed point to break up undesirable RF paths, without introducing appreciable plate voltage or RF loss.

4-6. ATTENUATOR.

4-7. The output from the oscillator is coupled to a pickup loop (L107) mounted at the end of a piston in the waveguide-below-cutoff attenuator. The distance between the pickup coil and the output coils on the turret is a fixed amount with the probe fully inserted. With this dimension fixed on each frequency range, the coupling is different. On the high range, with the attenuator probe at maximum penetration, the pickup coil becomes overcoupled with the output coil. In some instances, this overcoupling loads the tuned output circuit to an extent which causes the oscillator to stop. With this type of attenuator setup, the maximum penetration does not mean maximum output.

4-8. MODULATION.

4-9. Amplitude modulation of the 3200B is accomplished by capacitance coupling a modulating signal to the oscillator plate supply. This is shown in block diagram form (Fig. 4-3). With this type of modulation,

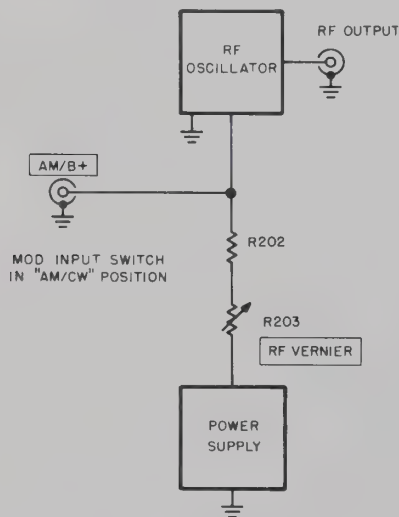


Fig. 4-3. Amplitude Modulation - 3200B

lation, up to 30% AM is possible with less than 1% distortion with input frequencies from 200 Hz to 100 KHz.

4-10. Pulse modulation of the 3200B is explained by the circuitry of Fig. 4-4. With no signal input, a -32 volt bias is applied to the oscillator tube grids through R401, junction A, L109, L110, R107, and

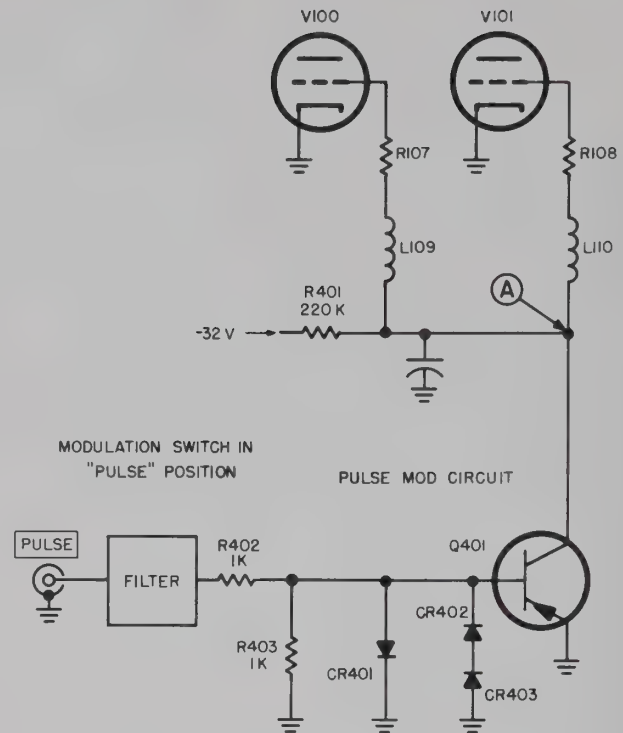


Fig. 4-4. Pulse Modulation - 3200B

R108. This bias will stop tube conduction, thereby stopping oscillation. Thus, with no input signal, there will be no output from the 3200B.

4-11. A 2.5 volt negative-going pulse applied to the base of transistor Q401 will cause the transistor to conduct as the pulse approaches the negative peak. The impedance between the emitter and collector will decrease sufficiently to dissipate the -32 volt bias across R401. This puts junction A at a very low impedance with respect to ground, allowing the tubes to oscillate. As the pulse starts in the positive direction returning to zero potential, the transistor stops conduction, restoring the -32 volt bias to the oscillator tube grids which stops the oscillator. Essentially, the transistor becomes a fast action switch controlling the -32 volt bias to the oscillator grids.

4-12. The circuitry to the base of the transistor has resistors to limit the input impedance of the PULSE input connector and diodes to limit voltage, which could cause damage to the transistor.

4-13. Positive-going pulses to the pulse input connector, with Mod Input Switch in "PULSE" position, will result in no output from the instrument.

4-14. EXTERNAL B+ OPERATION.

4-15. In the external B+ mode of operation, the oscillator plate voltage supply is disconnected. The plate supply input is connected to the AM/B+ connector. A controlled external power supply connected to the

AM/B+ connector will produce CW operation of the instrument. During external B+ operation a -6-volt bias is connected internally to the grid switch to keep it in the "ON" position, which removes the -32 v bias from the oscillator grids. This circuitry is shown in the block diagram (Fig. 4-5).

4-16. The Power Supply consists of two regulated supplies having a common power transformer. The outputs are 150 vdc, 40 ma. for the oscillator tube plate supply, and 6.3 vdc; 450 ma. for the oscillator tube heater supply. Each of the regulated supplies is a source of bias for operating the pulse modulation' (Z400) circuit (-6v) or turning off the oscillator (-32 v). A block diagram of the complete supply is shown in Fig. 4-6.

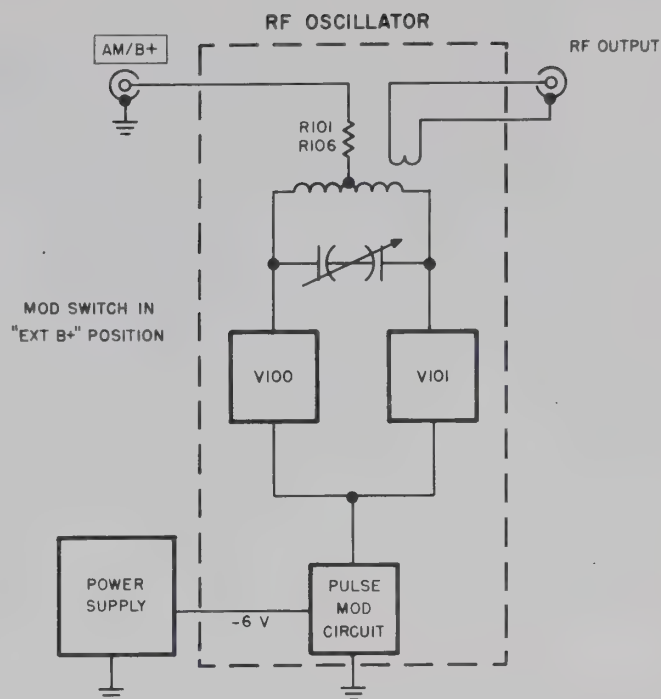


Fig. 4-5. External B+ Operation

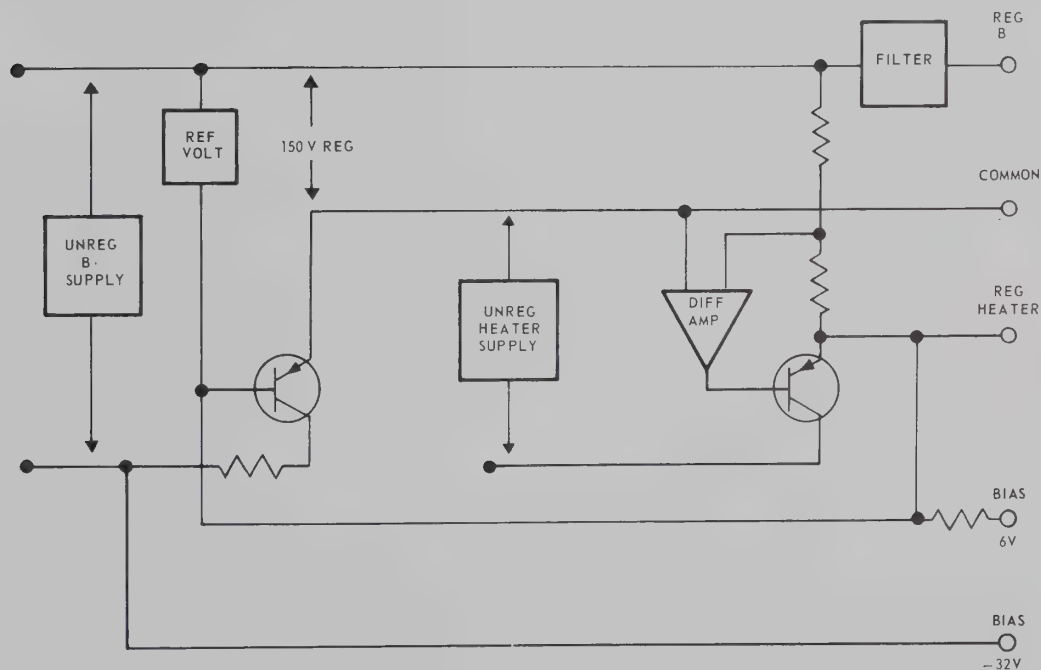


Fig. 4-6. Power Supply - 3200B

Instrument Type	For	Critical Specifications	Recommended Instrument
Electronic Counter	Performance; Adjustment and Calibration	Frequency Range: 0-500 MHz	-hp-5245L with -hp-5253B Plug-in
Power Meter	Performance; Adjustment and Calibration	Frequency Range: 10-500 MHz Power Range +10 dbm to -15 dbm or 10 dbw to -30 dbw (-hp-434A)	-hp-431B with -hp-478A Thermistor Mount or -hp-434A
10-db Attenuator	Performance; Adjustment and Calibration	To extend Power Range of the -hp-431B and to protect the electronic counter input from high power	GR874G10
20-db Attenuator			GR874G20
VHF Oscillator	Performance	RF Range: Same as 3200B Output: Same as 3200B	-hp-3200A/B
Oscilloscope	Performance; Adjustment and Calibration	Frequency Range: 450 kHz Sensitivity: 1mv/cm	-hp-140A with appropriate plug-in units
High Output Audio Oscillator	Performance	Output: 3w (42.5 v) across 600 ohms	-hp-201C or -hp-205AG
Diode Mixer	Performance	Frequency Range: Same as 3200B	GR 874VR
Electronic Voltmeter	Performance	ac-dc voltage Range: to 300 v Accuracy: $\pm 2\%$	-hp-410C
Distortion Analyzer	Performance	Frequency Range: 200 Hz to 100 kHz Distortion Range: Less than 1%	-hp-331A
50-ohm Termination	Performance	Capable of handling 1/2 watt	-hp-908A
Power Supply	Performance	0 to 7.5 volts	-hp-6203A
Probe Coax T Connector	Adjustment and Calibration	For use with the -hp-410C Electronic Voltmeter	-hp-11042A

Table 5-1. Test Equipment Recommended

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. The 3200B VHF Oscillator is a very compact instrument, which generally makes equipment difficult to maintain. However, by use of the disassembly procedure for trouble shooting and repair, as described under Mechanical Disassembly Procedures, this instrument can be readily serviced or maintained.

5-3. PERIODIC MAINTENANCE.

5-4. LUBRICATION.

5-5. The 3200B is adequately lubricated for the life of the instrument. Added lubrication is necessary only when lubricants are wiped off during replacement of parts. The instrument should be checked periodically. If the lubrication on the drum dial shaft or the frequency shaft becomes thick, a small amount of light oil should be added to thin the "Molykote" on the shafts. The detent roller should be inspected for lubrication at the bearing. "Molykote G" (-hp- number 6040-0024) or equivalent should be used on this bearing.

5-6. TRANSISTOR INSULATORS

5-7. Some of the transistors in this instrument are insulated electrically from the heat sink by mica. For maximum transfer of heat to the heat sink through the insulator, it is coated on both sides before assembly with silicone grease (-hp- number 8500-0059).

5-8. PERFORMANCE CHECKS.

5-9. PURPOSE.

5-10. The procedures of paragraphs 5-13 through 5-17 check the 3200B VHF Oscillator for incoming inspection, periodic evaluation, calibration, and trouble-shooting. The tests can be performed without instrument cover removal. The specifications of Table 1-1 are the performance standards.

5-11. TEST EQUIPMENT REQUIRED.

5-12. The test instruments required to make the performance checks are listed in Table 5-1. Test instruments other than those listed may be used provided their performance equals or exceeds the critical specifications.

5-13. RF RANGE AND ACCURACY.

- a. Connect the Electronic Counter/Converter

(with a 10-db attenuator) to the RF output of the 3200B, withdraw the attenuator probe to the first mark (approximately 1/2 inch), set the RF VERNIER to its maximum position, and allow a minimum of 1/2 hour warmup.

- b. On each frequency band, check the specified frequencies by setting the pointer on each nominal frequency shown on each band.

- (1) The frequencies, as read on the Electronic Counter, must fall within the limits shown in Table 5-2.

Nominal Frequency (MHz)	Upper Frequency Limit (MHz)	Lower Frequency Limit (MHz)
10	10.2	9.8
18.8	19.176	18.424
18.5	18.87	18.13
35	35.7	34.3
68	69.36	66.64
130	132.6	127.4
260	265.2	254.8
500	510	490

Table 5-2.

- (2) This instrument must be capable of producing all of the nominal frequencies shown with no more than 2% off-scale movement of the pointer.

5-14. RF STABILITY.

CAUTION: The -hp-5253B Frequency converter and the -hp-431B Power Meter may be damaged by overload. Extreme care must be used when operating these instruments with the 3200B, which has a high power RF output.

- a. Adjust the frequency of the 3200B to 100 MHz and allow the instrument to warmup for 4 hours (line voltage set to 115 v). RF VERNIER must be in MAX position.

- b. With attenuator probe withdrawn to the last calibration mark, attach the Power Meter to the RF output connector.

c. Slowly insert attenuator probe until the Power Meter reads .2 mw (—7 dbm). (This is an arbitrary value and need not be exact.)

d. Disconnect Power Meter and connect the Frequency Converter/Counter to the RF output connector.

e. Readjust the 3200B Frequency Control until the counter reads approximately 100 MHz.

f. Note counter reading and allow instrument to operate for 5 minutes. Note counter reading

- (1) The reading, after 5 minutes, should be within 0.002% of original frequency reading. At 100 MHz this is ± 500 Hz.

g. After 1 hour note counter reading.

- (1) The reading after 1 hour should be within .02% of original frequency reading. At 100 MHz this is ± 5 kHz.

h. Readjust the line voltage from 115 v to 120 v. Note counter reading.

- (1) The frequency must not change by more than .001% of reading in Step g. At 100 MHz this is ± 1 kHz.

5-15. RF OUTPUT.

a. Connect a 20-db attenuator and power meter to the RF output connector with the 3200B attenuator near minimum output.

b. Set the 3200B range switch to the 10—18.8 MHz range.

c. Insert 3200B attenuator probe until power meter reads 2 mw. Check RF output across the band, readjusting 3200B attenuator probe if output drops below 2 mw.

- (1) Output must be greater than 2 mw across the band. (Actual power output is greater than 200 mw.)

d. Repeat step c on 18.5—35 MHz, 35—68 MHz, and 68—130 MHz ranges.

e. Set the 3200B range Switch to the 130—260 MHz range.

f. Insert 3200B attenuator probe until power meter reads 1.5 mw. Check RF output across the band, readjusting the 3200B attenuator probe if output drops below 1.5 mw.

- (1) Output must be more than 1.5 mw across the band. (Actual power output is greater than 150 mw.)

g. Set the 3200B attenuator for minimum output with Range Switch in 260—500 MHz range.

h. Remove the 20-db attenuator and replace it with the 10-db attenuator.

i. Insert 3200B attenuator probe until power meter reads 2.5 mw.

CAUTION: When setting the attenuator, the probe must not be completely inserted in the tube while the instrument is operated at the low frequency end of the 260 to 500 MHz range. The loading on the oscillator by the attenuator could cause the oscillator to stop. In this condition, the tubes will draw excessive current causing the B supply fuse (2A) to open.

j. Check the output across the band, readjusting the 3200B attenuator probe if the output drops below 2.5 mw.

- (1) Output must be greater than 2.5 mw across the band. (Actual power output is greater than 25 mw.)

5-16. AM RANGE AND AM DISTORTION.

a. Connect the equipment as shown in Fig. 5-1. RF output frequency from 3200B under test is not significant.

b. With input to modulation terminals on 3200B temporarily disconnected, adjust the second VHF Oscillator for zero beat as observed on oscilloscope. (Use oscilloscope internal sweep for this setup.)

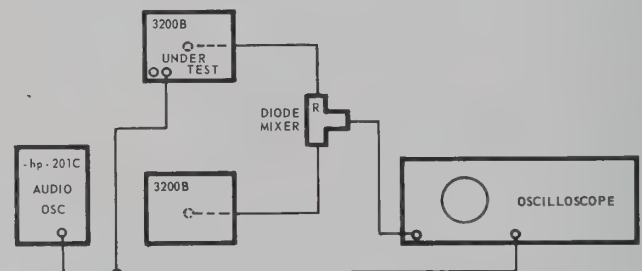


Fig. 5-1. AM Characteristics Setup

c. Adjust the second VHF Oscillator away from zero beat until a clean rectangle is observed (Fig. 5-2A).

d. Connect the audio oscillator to the modulation input terminals on the 3200B under test. Set the audio frequency between 200 Hz and 20 kHz.

e. Adjust the audio oscillator output to form a trapezoid which has a long vertical side of 10 oscilloscope divisions and a short vertical side of 5.39 oscilloscope divisions (Fig. 5-2B). (The oscilloscope pattern width is not important but must be kept within screen limits for observing sides of pattern.)

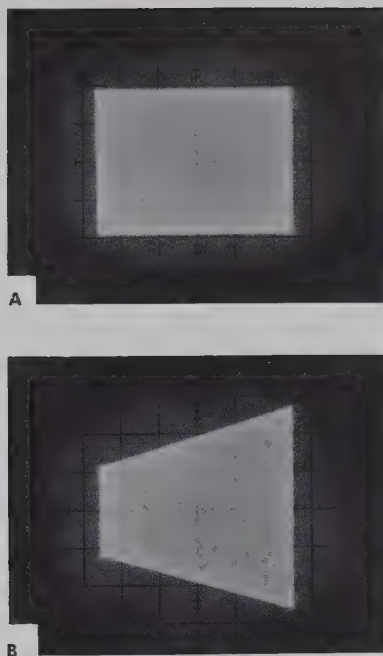


Fig. 5-2. AM Characteristics
Oscilloscope Displays

- (1) At this point the RF is amplitude modulated 30%.

f. Connect the AC VTVM across the modulation input AM/CW connector.

- (1) The meter reading shall be $20\text{ v} \pm 7\text{ v}$.

g. Disconnect the 3200B used as a beat frequency oscillator and add the 50-ohm termination in its place at diode mixer. Replace the oscilloscope with the distortion analyzer.

h. Measure the distortion of the recovered audio.

i. Without changing the audio oscillator setting, measure the audio oscillator distortion directly.

- (1) The difference in distortion between the recovered audio frequency and the output of the audio oscillator should be less than 1%.

5-17. EXTERNAL PM REQUIREMENTS.

a. Connect the equipment as shown in Fig. 5-3.

b. Disconnect the power supply temporarily and set the 3200B for AM/CW operation with an output frequency of 100 MHz. (This frequency is not critical and may be changed to suit equipment available for this test.)

c. Adjust the 3200B attenuator probe for maximum output as indicated on the oscilloscope. (Using a diode detector with CW, the output appears as a straight line at some dc level on the oscilloscope.)

d. Connect the power supply to the AM/B+ connector. Change the modulation input switch to the PULSE position.

e. Increase the power supply output until the level indicated on the oscilloscope is the same as in Step c.

f. Measure the dc voltage level of the power supply.

- (1) The dc voltage should be 2.5 volts or less.

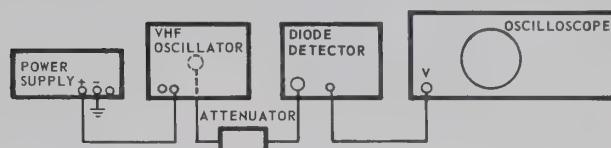


Fig. 5-3. PM Requirements Setup

5-18. **TROUBLE SHOOTING AND REPAIR.**

WARNING: Removing the top cover of the instrument exposes the power transformer secondary winding connections on the printed circuit board which constitutes a shock hazard if the instrument is operated in this condition.

5-19. TROUBLE SHOOTING CHART.

5-20. The Trouble Shooting Chart, Fig. 5-4, is in the form of a trouble shooting tree. The tree shows a logical sequence to be used for determining a fault when the power output from the 3200B is too low or when there is no output. Follow each step toward the normal (T-true) or abnormal (F-false) condition as determined by indicated tests.

5-21. TUBE AND SEMICONDUCTOR REPLACEMENT

5-22. All tubes and semiconductors are easily accessible after the 3200B is disassembled for trouble shooting and repair as described under Mechanical Disassembly Procedures, Par. 5-25.

5-23. VOLTAGE AND RESISTANCE CHART

5-24. The Voltage and Resistance Chart, Table 5-3, indicates normal operating conditions for the VHF Oscillator while in the trouble shooting condition (RF shield removed and no load on the output). Voltages were checked with a VTVM (-hp-410B). Resistance readings were made under the same conditions with the power disconnected. Some resistance readings were omitted as they have no significance; i.e., cases where electrolytic capacitors or semiconductor devices are connected in the circuit.

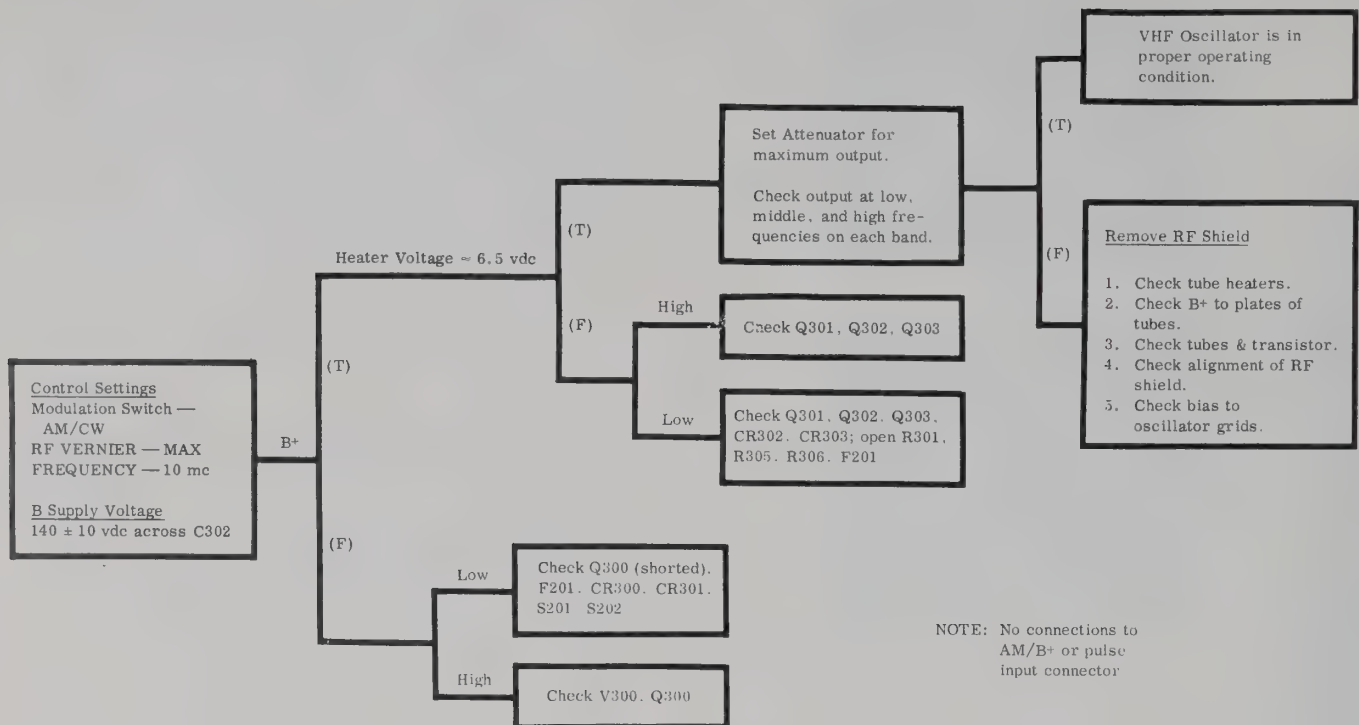


Fig. 5-4. Trouble Shooting Tree - Power Output

5-25. MECHANICAL DISASSEMBLY PROCEDURES.

5-26. TOP AND BOTTOM COVERS.

- Remove two screws at the rear of the instrument.
- Slide cover toward the rear of the instrument to disengage lip at front panel.

5-27. RIGHT AND LEFT SIDE COVERS.

- Remove four screws from the side covers. Top and bottom covers need not be removed to remove side covers.

5-28. TROUBLE SHOOTING AND REPAIR SETUP (FIG. 5-5).

- Remove top, bottom, and side covers.
- At rear of instrument, remove attenuator probe. Rotate attenuator retaining ring one complete turn. Slide retaining ring and locking spring off of attenuator tube.

NOTE: Locking pin will remain in tube. During reassembly of retaining ring, the pin must be pressed back in place.

- Remove plug P200 from receptacle J200.
- At right side of the instrument, remove the two screws retaining the rear panel and one screw retaining the printed circuit board.

- At left side of the instrument, remove the one screw retaining the front panel switch plate and the two screws retaining the RF base plate assembly.

- Carefully separate the instrument into two pieces. The left side and rear panel constitute one piece. The right side and lower front panel constitute the second piece.

NOTE: Care should be taken as the upper front panel, front panel window, and window mask will be loose parts and should be removed during trouble shooting and repair procedures.

- Remove four screws retaining the RF shield casting and slide it carefully away from the RF base plate assembly.

- Replace P200 plug in J200 receptacle.

- The 3200B is now in operating condition. The attenuator probe may be placed in approximately normal position by reversing the RF shield casting.

5-30. FRONT PANEL DISASSEMBLY.

- Remove top, bottom, and side covers.
- At left side of the instrument, remove the one screw retaining the front panel switch plate, two screws retaining the RF base plate assembly. At right side, remove one screw retaining the printed circuit board.

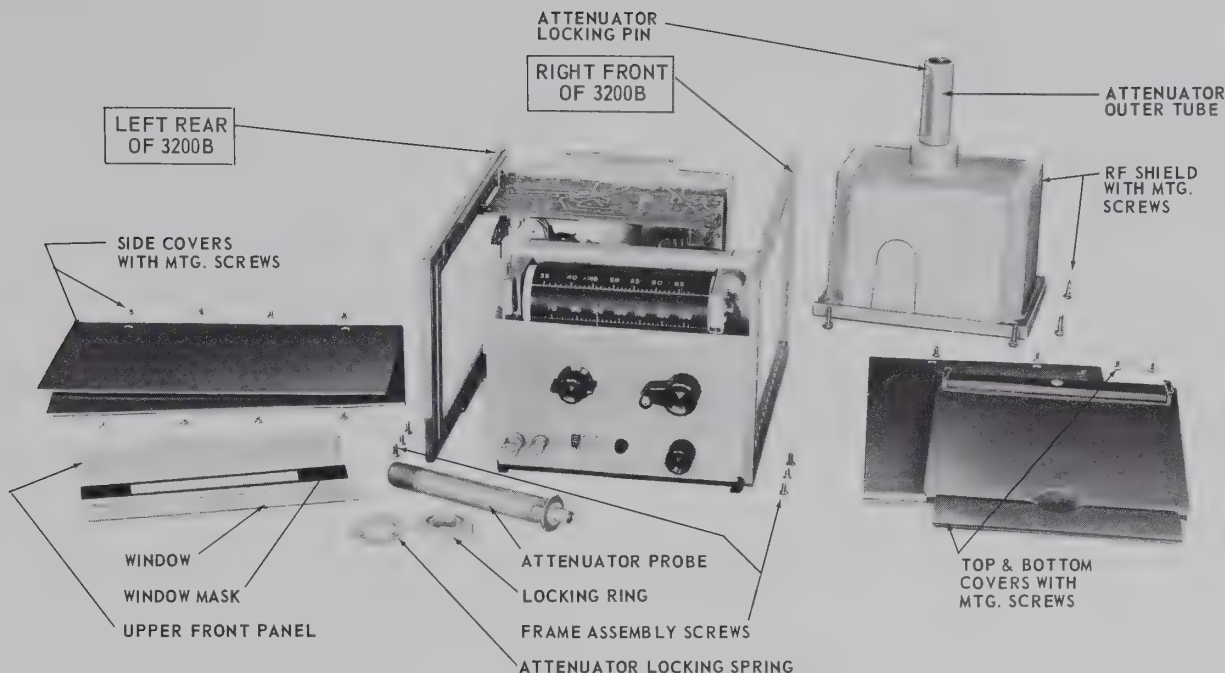


Fig. 5-5. Trouble Shooting and Repair Setup

c. At left side of the instrument, loosen the two screws retaining the rear panel.

d. At right side of the instrument, remove one screw retaining the front panel switch plate.

e. Using a 5/64 inch Allen wrench, remove the two front panel control knobs.

f. Carefully separate the left side frame from the front panel.

NOTE: Care should be taken as the upper front panel, front panel window, and window mask will be loose parts and should be removed during this procedure.

g. Carefully separate the right side frame from the front panel.

5-31. The front panel will be restrained only by the wires attached.

5-32. TURRET ASSEMBLY REMOVAL.

5-33. The turret assembly may be readily removed with the 3200B in the trouble shooting and repair condition. However, the turret position on the shaft is very critical and the RF frequency alignment should be checked after replacement. (See RF Calibration, Par. 5-39 before removing turret).

5-34. DIAL STRINGING PROCEDURE (Fig. 5-6).

5-35. The dial stringing should be done with the front panel disassembled, but not disconnected from the instrument.

a. Using approximately 4 feet of .027 inch diameter, nylon covered, glass core dial cord, thread about 15 inches of cord through the right side hole in the cursor.

b. Loop the cord once around pin on cursor and thread balance of cord through left side hole in cursor. (See Fig. 5-6.)

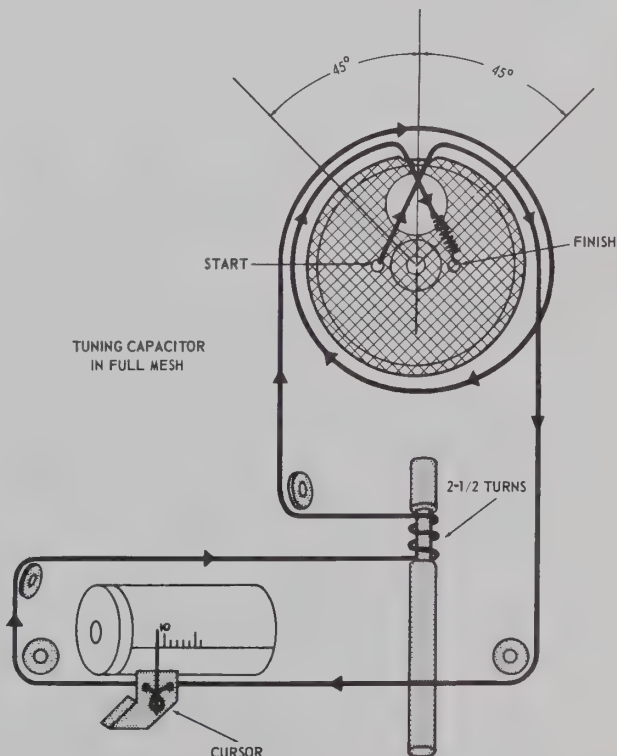


Fig. 5-6. Dial Stringing

c. Thread the 15-inch section of cord around the small right side pulley, through the RF base plate, and around the large pulley to the "start" pin on the large pulley.

d. At this point, the notch in the large pulley should face the rear of the instrument ($\pm 45^\circ$), and the dial pointer should be near the 10 MHz calibration mark. Secure the dial cord on pin.

e. Thread the dial cord around the small left side pulley, the angle pulley, etc. as shown in Fig. 5-5.

f. Before securing the cord on the dial spring, adjust tension so as to extend spring no more than 1/8 inch.

g. The frequency control should be rotated to the extremes of the dial travel to assure proper operation.

h. With the tuning capacitor fully meshed, the dial pointer should be 1/32 to 1/16 inch to the left of the 10 MHz calibration mark. Required adjustment can be made by slipping the pulley on the tuning capacitor shaft.

5-36. ADJUSTMENT AND CALIBRATION.

5-37. Any tolerances listed in this section are the limits indicated by the Specifications in Table 1-1. Factory adjustments are made to considerably closer tolerances. Field adjustments to closer than specified tolerances are possible if time and patience are used.

5-38. POWER SUPPLY.

a. Connect the 3200B to the power source set to 115 v. Connect the VTVM (dc function) from junction CR305—R303 (—) on printed circuit board and chassis ground (+).

b. Heater voltage should be $-6.6 \text{ v} \pm 0.13 \text{ vdc}$. Readjust R306 (Htr Adj) if required. (-6.6 v at power supply is equivalent to -6.0 v at tube socket terminals.)

c. Change input voltage to 125 v and then 105 v. Heater voltage must be within $\pm 2\%$ of voltage in Step b.

d. Disconnect the VTVM and connect the oscilloscope in its place.

e. The ac signal on the heater line must be less than 50 mv P-P.

f. Change the oscilloscope connections to points across capacitor C302.

g. The ac signal on the B supply line must be less than 20 mv P-P.

h. Disconnect the oscilloscope and connect the VTVM between chassis ground and pin #1 or #5 of V300.

i. The B supply voltage should be $150 \text{ v} \pm 10 \text{ v}$.

5-39. RF CALIBRATION INCLUDING TURRET REASSEMBLY PROCEDURES.

5-40. After the original factory calibration, the only reason for recalibration would be as a result of replacing the turret, a critical component mounted on the tube shelf, or the complete tube shelf assembly.

5-41. Before attempting turret disassembly or frequency calibration, the following information should be noted:

a. The original turret may be removed and replaced without complete calibration, if it is replaced as precisely as possible in its original position on the shaft. A scribe mark on the shaft can be used as a guide for position along the shaft. The turret contacts should be centered on the capacitor contacts.

b. The position of the turret along the shaft is restricted by the ability of the turret to operate switch S101 on the two lower frequency ranges; also, the ability of the turret tuned circuit on the 260 to 500 MHz range to allow the instrument to tune the range required.

c. The normal mechanical tolerances of the holes used for mounting the RF shield casting is such as to affect the calibration. Shifting the casting slightly will change frequency and output power slightly so the correct position should be checked electrically.

d. The attenuator probe must be properly oriented with respect to the turret. Changing the turret could result in mechanical interference.

e. There is circuitry in the 3200B used to suppress parasitics. C108 is the only adjustable component which serves this purpose. The other circuitry is not adjustable but is controlled by component position and lead length. If replacement is required, these parts should be replaced as close as possible to their original position.

(1) The suppressor circuits consist of:

- (a) C117 and R110
- (b) C119, R111, and R112
- (c) C120, C108#, R109, and L108
- (d) C121, R113, and R119

#See adjustment under Par. 5-43, Step d.

f. The calibration of this instrument can be performed with the RF shield removed and the attenuator

probe supported in a position approximately 1/2" from the turret simulating its normal position. Replacing the RF shield will increase the frequency by nominally 1%. For increased accuracy, the instrument should be checked with the shield in place. To touch-up the core adjustment of any or all of the four lower frequency ranges the threaded plug may be removed to gain access to the core. The access hole is located so as to require 180° rotation of the range switch to place the required turret coil in position for adjustment. A trial and error procedure will have to be followed.

- (1) To decrease inductance, rotate core in clockwise direction.

g. If the overall calibration of the 3200B is off by approximately the same amount and in the same direction (either too high or too low) the pulley on the tuning capacitor may be slipped on the shaft to compensate for the error.

h. Changing tubes or normal aging of components in the 3200B should not require complete recalibration of the instrument. Typically the change in frequency is within the normal tolerance specified for the 3200B.

5-42. TURRET REASSEMBLY.

- a. Set range switch to the 10—18.8 MHz range.
- b. Slide the turret on the shaft so that the turret contacts do not touch the capacitor contacts when the turret is moved along the shaft.
- c. Rotate the turret until the turret contacts are centered on the capacitor contacts, and tighten set screws enough to hold turret in place.
- d. On the lower two ranges, switch S101 must be operated by the cam on the turret.
- e. Change range switch to the 260—500 MHz range and check end frequencies (260 and 500 MHz) using a frequency counter.
 - (1) If an original turret is being reassembled, the range should be correct but the dial settings may be off (either too high or too low). In this case, the turret may be moved closer to the front of the instrument to increase the output frequencies or toward the rear to decrease the frequencies. Only a few thousandths of an inch movement will be required.
 - (2) If a new turret is being assembled on the shaft, the new turret should be set as closely as possible to the original turret position and the calibration procedure used for adjustment.
- f. Check the other five ranges to assure proper calibration. (See calibration procedure, Par. 5-43, for adjustment, if required.)

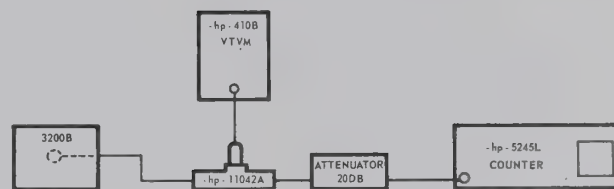


Fig. 5-7. RF Calibration Setup

5-43. CALIBRATION.

NOTE: See trouble shooting and repair setup under Mechanical Disassembly Procedures, Par. 5-28.

a. The RF shield cover should be reversed so it may be used to hold the attenuator probe in a somewhat normal position about 1/2 inch from the turret.

b. Connect the equipment as shown in Fig. 5-7.

c. Set the range switch to the 260—500 MHz range. Check the frequency at 260 and 500 MHz. The counter should read within $\pm 2\%$ of dial setting. If not, adjust the inductance of the inductor for this range by adding or removing solder from the slots in the inductor. For a small change in the inductance, the turret may be moved along the shaft.

- (1) Move the turret away from the RF tube shelf to increase the inductance in the capacitor contacts. This effectively reduces stray capacitance between the turret and the tube shelf.
- (2) Move the turret toward the RF tube shelf to decrease the inductance in the capacitor contacts. This increases the stray capacitance between the turret and the tube shelf.

d. At 260 MHz, adjust the attenuator probe for maximum output. This should be 25 mw (approx. 1.1 v on the VTVM, assuming ideal conditions). Adjust C108 for maximum output as read on the VTVM.

e. Change to the 130—260 MHz range. Check 130 and 260 MHz frequencies. The counter should read within $\pm 2\%$ of dial settings. If not, adjust inductance by bending coils to increase or decrease inductance.

f. The four lower frequency ranges should be checked and inductances adjusted by means of the ferrite core in each inductor.

NOTE: If any of these coils require adjustment, the coils should be recoated with communications Products Co—Q-max A-27 and the turret baked for 1 hour at 100° C.

g. Replace the RF shield cover and the attenuator. The four mounting screws should be adjusted so as to exert equal pressure at each screw.

h. Check power output on all ranges. The power output must be greater than:

- (1) 200 mw (3.2 v across external 50 ohms) on the 10 — 18.8 MHz, 18.5 — 35 MHz, and 68 — 130 MHz ranges.
- (2) 150 mw (2.7 v across external 50 ohms) on the 130 — 260 MHz range.

- (3) 25 mw (1.1 v across external 50 ohms) on the 260 — 500 MHz range.

5-44. For more accurate measurement of the output power, the -hp- 431B Power Meter (or equivalent) with an -hp- 478A Thermistor Mount is recommended in addition to a low VSWR 20-db attenuator.

Schematic Ref.	Voltage	Resistance	Remarks
A	170 vac	600 Ω	
B	150 vdc	N/S	Regulated B+
C	0 v	0 Ω	B+ Supply & Htr. Common
D	-6.6 vdc	4 Ω	Htr. Supply
E	11 vac	N/S	
F	-6.3 vdc	N/S	
G	-14.8	N/S	
H	-6.4 vdc	N/S	
I	-15 vdc	N/S	
J	135 vdc	N/S	
K	-6.0 vdc	N/S	
L	-9 to -25 vdc	N/S	Voltage varies with frequency S202 in AM/CW or EXT B+ Position
	-32 v	N/S	S202 in Pulse Position
M	-32 v	N/S	
N	-6.6 v	1 K Ω	S202 in AM/CW or EXT B+ Position
	0	1 K Ω	S202 in Pulse Position
<p>NOTES: 1. All voltages and resistances use chassis ground as reference.</p> <p>2. N/S - not significant</p> <p>3. Voltages and resistances in this chart are typical except for those indicated in Section VI - Maintenance.</p>			

Table 5-3. Voltage and Resistance Chart

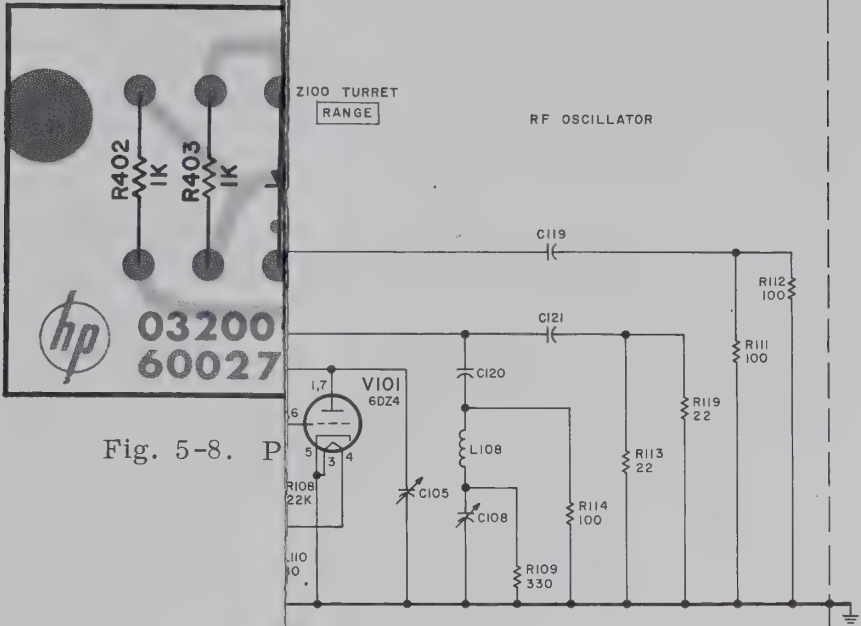


Fig. 5-8. P

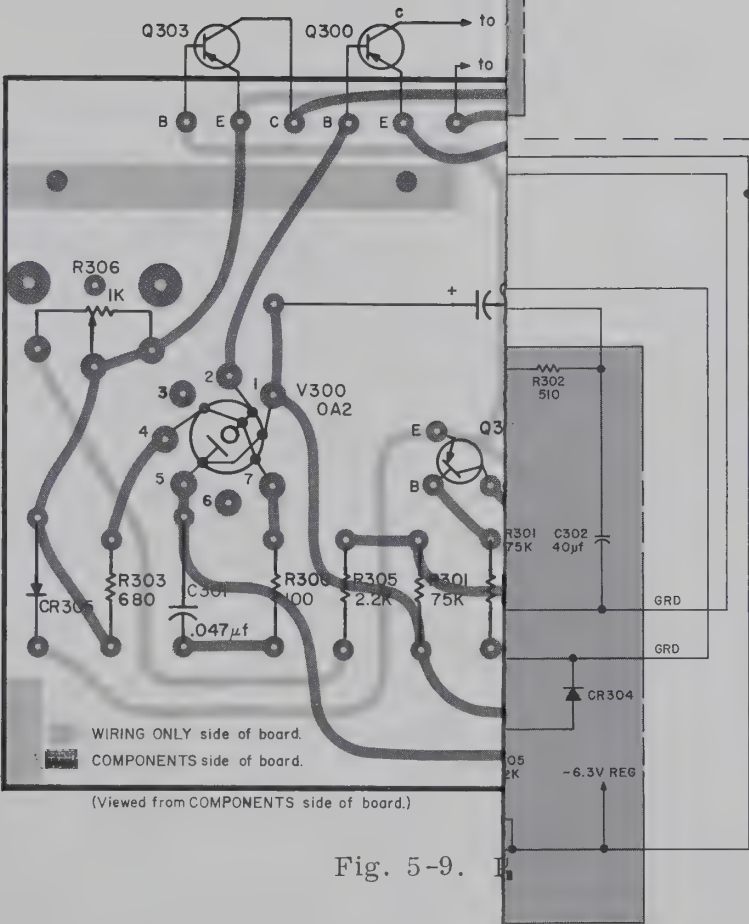


Fig. 5-9. P

NOTES:

1. Resistance is in ohms, capacitance in picofarads and inductance in microhenries unless otherwise specified.
2. Indicates Front Panel Designation
3. Reference for Voltage & Resistance Chart
4. Indicates color code of wires using RETMA standard colors vs. numbers, e.g., 602: Blue-Black-Red
5. Use 1/2 amp. fuse for 115 v operation and 1/4 amp. fuse for 230 v operation.
6. S200 is part of R203.
7. S101 is operated by cam on turret; contacts close on 10 - 18.8 MHz and 18.5 - 35 MHz ranges only.
8. The following capacitors are special and the values are not critical:

Ref. Sym	Description
C117	Capacitance between ring on pulley and base plate
C119	Capacitance between resistor leads and Rotor Shaft
C120	Capacitance across Rotor thrust bearing
C121	Capacitance between C103 1/4" rod and C103 Rotor

9. Inductor vs. Range:

L101	10 - 18.8 MHz
L102	18.5 - 35 MHz
L103	35 - 68 MHz
L104	68 - 130 MHz
L105	130 - 260 MHz
L106	260 - 500 MHz

10. Due to the interlock feature of V300 (0A2), the Power Supply will not operate with this tube removed from its socket.

Fig. 5-12. Schematic Diagram - 3200B

h. Check power output on all ranges. The power output must be greater than:

(1) 200 mw (3.2 v across external 50 ohms) on the 10 — 18.8 MHz, 18.5 — 35 MHz, and 68 — 130 MHz ranges.

(2) 150 mw (2.7 v across external 50 ohms) on the 130 — 260 MHz range.

(3) 25 mw (1.1 v across external 50 ohms) on the 260 — 500 MHz range.

5-44. For more accurate measurement of the output power, the -hp- 431B Power Meter (or equivalent) with an -hp- 478A Thermistor Mount is recommended in addition to a low VSWR 20-db attenuator.

Schematic Ref.	Voltage	Resistance	Remarks
A	170 vac	600 Ω	
B	150 vdc	N/S	Regulated B+
C	0 v	0 Ω	B+ Supply & Htr. Common
D	-6.6 vdc	4 Ω	Htr. Supply
E	11 vac	N/S	
F	-6.3 vdc	N/S	
G	-14.8	N/S	
H	-6.4 vdc	N/S	
I	-15 vdc	N/S	
J	135 vdc	N/S	
K	-6.0 vdc	N/S	
L	-9 to -25 vdc	N/S	Voltage varies with frequency S202 in AM/CW or EXT B+ Position
	-32 v	N/S	S202 in Pulse Position
M	-32 v	N/S	
N	-6.6 v	1 K Ω	S202 in AM/CW or EXT B+ Position
	0	1 K Ω	S202 in Pulse Position
<p>NOTES: 1. All voltages and resistances use chassis ground as reference.</p> <p>2. N/S - not significant</p> <p>3. Voltages and resistances in this chart are typical except for those indicated in Section VI - Maintenance.</p>			

Table 5-3. Voltage and Resistance Chart

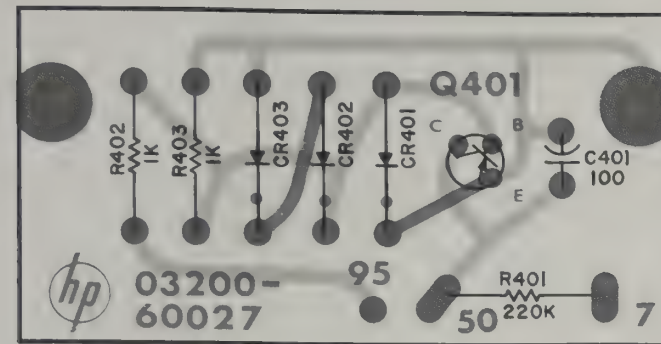


Fig. 5-8. Printed Circuit Board (Z400)

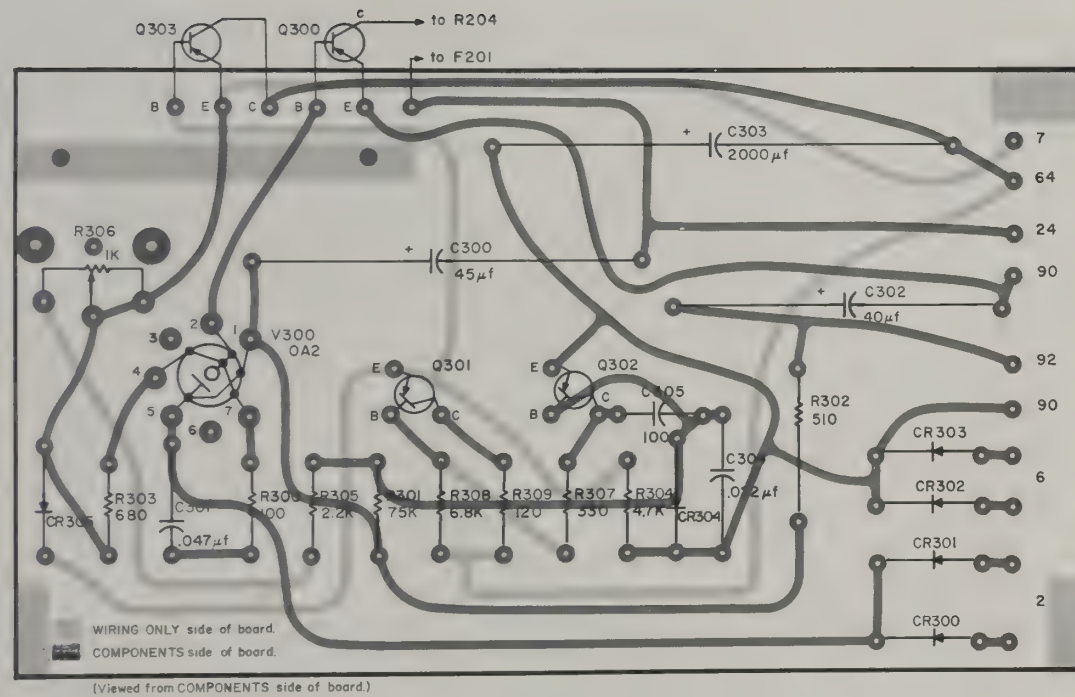


Fig. 5-9. Printed Circuit Board (Z300)

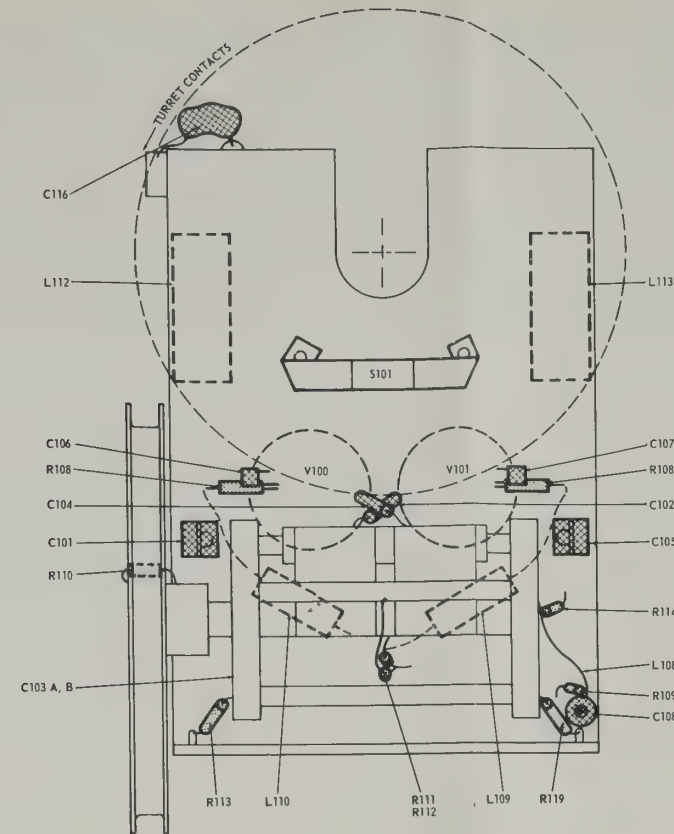


Fig. 5-10. Parts Identification - RF Tube Shelf

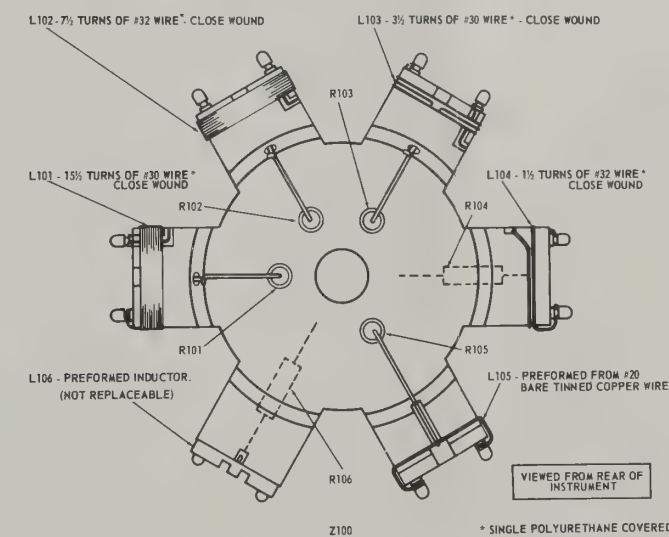


Fig. 5-11. Coil Data - RF Turret Assembly

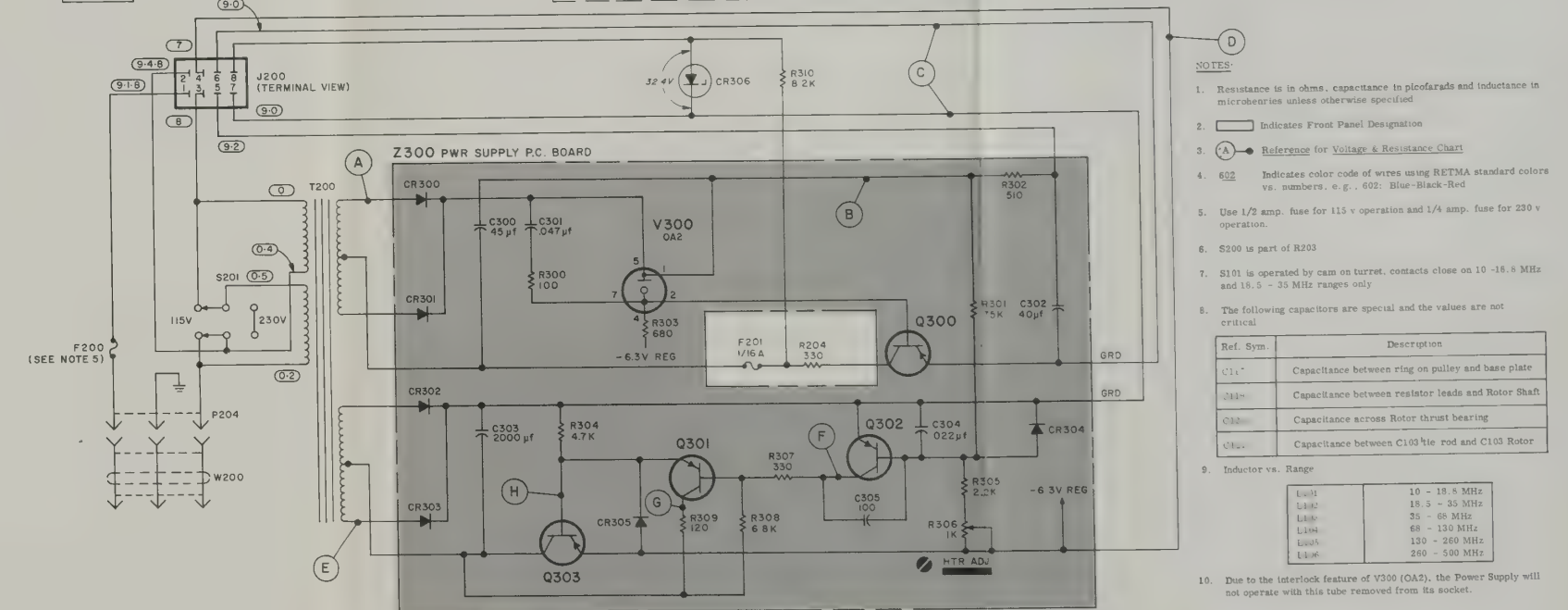
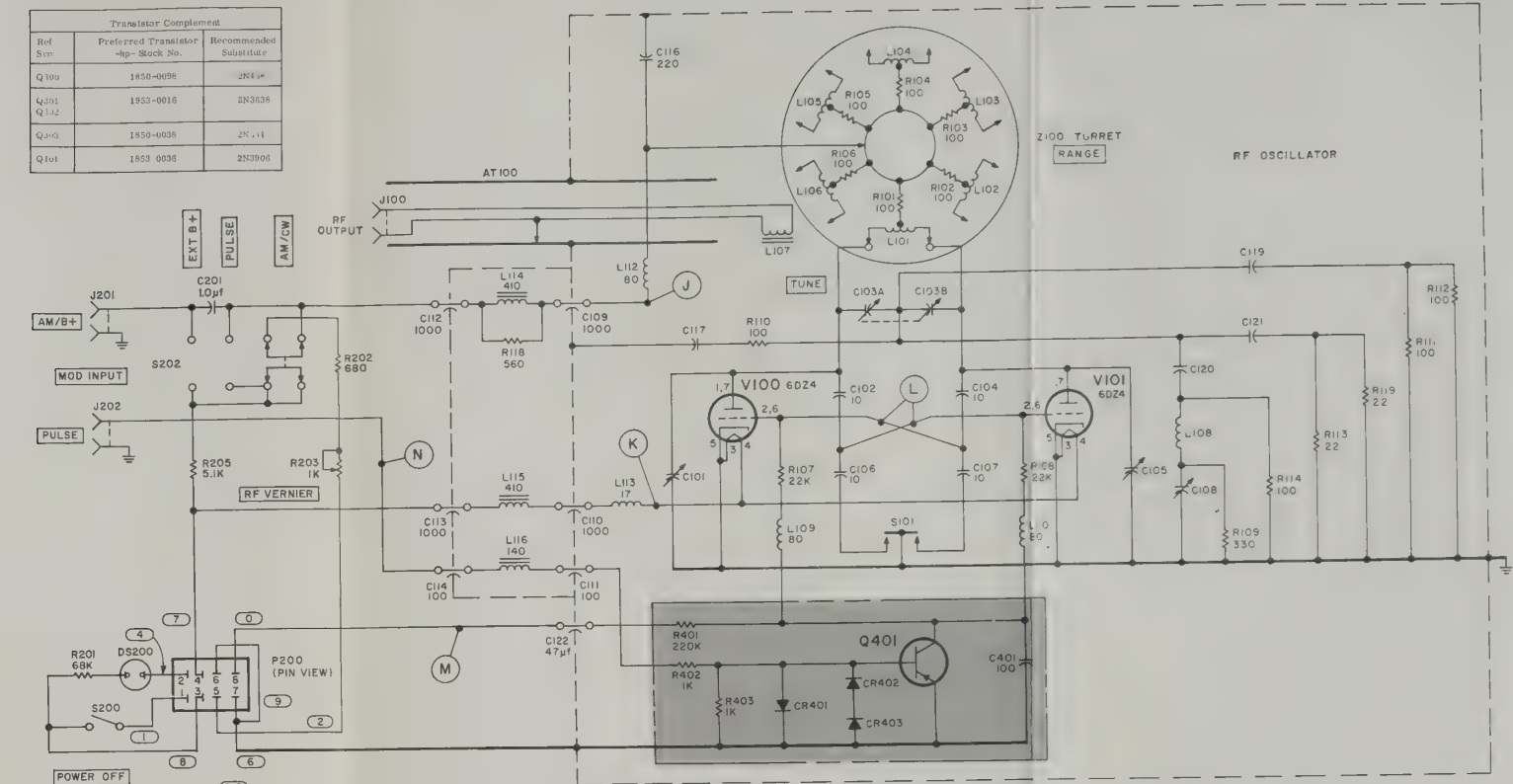


Fig. 5-12. Schematic Diagram - 3200B

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designations and indicates the description and -hp- stock number of each part, together with any applicable notes. Table 6-2 lists parts in alpha-numerical order of their -hp- stock number and provides the following information on each part:

- a. Description of the part (see list of abbreviations below).
- b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Par. 6-7.
- c. Manufacturer's part number.
- d. Total quantity used in the instrument (TQ column).

6-3. Miscellaneous mechanical parts are listed in Table 6-2. An Illustrated Parts Identification follows Table 6-2.

6-4. ORDERING INFORMATION.

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard sales and service office (see lists at rear of this manual). Identify parts by Hewlett-Packard stock number.

6-6. To obtain a part not listed, include:

- a. Instrument model number
- b. Instrument serial number
- c. Description of part
- d. Function and location of parts

6-7. LIST OF MANUFACTURERS

Code	Manufacturer
01121	Allen-Bradley Co.
07115	Corning Glass Works, Electronic Comp. Dept.
14655	Cornell-Dubilier Elec. Corp.
42190	Muter Co.
53021	Sangamo Elec. Co.
56289	Sprague Elec. Co.
70903	Belden Mfg. Co.
71400	Bussmann Fuse Div. McGraw-Edison Co.
71785	Cinch Mfg. Co.
72765	Drake Mfg. Co.
72982	Erie Resistor Corp.
75915	Littelfuse, Inc.
78553	Tinnerman Products, Inc.
79136	Waldes Kohinoor, Inc.
79727	Continental Wirt Elec. Corp.
87930	Tower Mfg. Corp.
91506	Augat Bros., Inc.
95712	Dage Elec. Co.
98291	Sealelectro Corp.
Glenco	Glenco Corp.
IGC	General Ceramic Div., Indiana General Corp.
UST	U. S. Terminals

REFERENCE DESIGNATORS

A = assembly	E = misc electronic part	MP = mechanical part	TB = terminal board
B = motor	F = fuse	P = plug	TP = test point
C = capacitor	FL = filter	Q = transistor	V = vacuum tube, neon bulb, photocell, etc.
CP = coupling	J = jack	R = resistor	W = cable
CR = diode	K = relay	RT = thermistor	X = socket
DL = delay line	L = inductor	S = switch	Y = crystal
DS = device signaling (lamp)	M = meter	T = transformer	

ABBREVIATIONS

A = amperes	GE = germanium	N = nano (10^{-9})	RMS = root-mean-square
A. F. C = automatic frequency control	GL = glass	N/C = normally closed	ROT = rotary
AMPL = amplifier	GMV = guaranteed minimum value	NE = neon	
	GRD = ground(ed)	NI PL = nickel plate	S-B = slow-blow
B. F. O = beat frequency oscillator		N/O = normally open	SCR = screw
BE CU = beryllium copper	H = henries	NPO = negative positive zero	SE = selenium
BH = binder head	HEX = hexagonal	(zero temperature coefficient)	SECT = section(s)
BP = bandpass	HG = mercury	NLFR = not recommended for field replacement	SEMICON = semiconductor
BR = brase	HR = hour(s)	NSR = not separately replaceable	SI = silicon
BWO = backward wave oscillator			SIL = silver
	IF = intermediate freq		SL = slide
CCW = counter-clockwise	IMPG = impregnated	OBD = order by description	SPL = special
CER = ceramic	INCD = incandescent	OH = oval head	SST = stainless steel
CMO = cabinet mount only	INCL = include(s)	OX = oxide	SR = split ring
COEF = coefficient	INS = insulation(ed)		STL = steel
COM = common	INT = internal	P = peak	
COMP = composition		PC = printed circuit	TA = tantalum
CONN = connector	K = kilo = 1000	PF = picofarads $\times 10^{-12}$ farads	TD = time delay
CP = cadmium plate		PH BRZ = phosphor bronze	TI = titanium
CRT = Cathode-ray tube	LIN = linear taper	PHL = Phillips	TGL = toggle
CW = clockwise	LK WASH = lock washer	PIV = peak universe voltage	TOL = tolerance
	LOG = logarithmic taper	P/O = part of	TRIM = trimmer
DEPC = deposited carbon	LPF = low pass filter	POLY = polystyrene	TWT = traveling wave tube
DR = drive		PORC = porcelain	
		POS = position(s)	U = micro = 10^{-6}
ELECT = electrolytic	M = milli = 10^{-3}	POT = potentiometer	VAC = vacuum
ENCAP = encapsulated	MEG = meg = 10^{-6}	PP = peak-to-peak	VAR = variable
EXT = external	METFLM = metal film	PT = point	VDCW = dc working volts
	MET OX = metal oxide		
	MFR = manufacturer	RECT = rectifier	W = watts
F = farads	MINAT = miniature	RF = radio frequency	W. = with
FH = flat head	MOM = momentary	RH = round head	W/O = without
FIL H = fillister head	MTG = mounting	RMO = rack mount only	WW = wirewound
FXD = fixed	MY = "mylar"		

Table 6-1. Reference Designation Index

Reference Designation	Stock No.	Description	Note
AT100	03200-60011	Attenuator Probe	
C101	03200-00005	Trimmer, Minimum "C"	
C102	0160-0434	C: fxd, cer, 10 pf, 10%, 500 vdcw	
C103A, B	0121-0101	C: var, 3.5-31.5 pf	
C104	0160-0434	C: fxd, cer, 10 pf, 10%, 500 vdcw	
C105	03200-00005	Trimmer, Minimum "C"	
C106, 107	0160-0919	C: fxd, cer, 10 pf, 10%, 150 vdcw	
C108	0132-0002	C: var, trimmer 0.7-3.9 pf	
C109, 110	0160-0480	C: fxd, feedthru, 1000 pf, 500 vdcw	
C111	0160-0415	C: fxd, cer, feedthru, 100 pf, 500 vdcw	
C112, 113	0160-0345	C: fxd, feedthru, 1000 pf, 500 vdcw	
C114	0160-2162	C: fxd, feedthru, 100 pf, 20%, 500 vdcw	
C116	0160-0952	C: fxd, mica, 220 pf, 1%, 500 vdcw	
C117		Part of 03200-60024 Pulley Cap Assembly- - not replaceable	
C119, 121		Capacitor, Special: not replaceable	
C122	0160-2163	C: fxd, paper, feedthru, .47 μ f, 20%, 100 vdcw	
C201	0160-0492	C: fxd, mylar, 1.0 μ f, 10%, 200vdcw	
C300	0180-1748	C: fxd, elect, 45 μ f, 250 vdcw	
C301	0170-0040	C: fxd, my, 0.047 μ f, 10%, 200 vdcw	
C302	0180-0295	C: fxd, elect, 40 μ f, 150 vdcw	
C303	0180-0345	C: fxd, elect, 2000 μ f, 25 vdcw	
C304	0170-0024	C: fxd, my, .022 μ f, 20%, 200 vdcw	
C305	0140-0054	C: fxd, mica, 100 pf, 500 vdcw	
C401	0160-2006	C: fxd, mica, 100 pf, 10%, 500 vdcw	
CR300, 301	1901-0029	Diode: Si, 600 Piv, 0.5a	
CR302, 305	1901-0049	Diode: Si, 50 Piv, 0.5a	
CR306	1902-0186	Diode: Avalanche, 32.4 v, 5%, 400 mw	
CR401-403	1901-0049	Diode: Si, 50 Piv, 0.5a	
DS200	1450-0048	Light, Indicator	
F200	2110-0008	Fuse: Cartridge, 1/2 A, 250v, SLO-BLO (115 v)	
	2110-0018	Fuse: Cartridge, 1/4 A, 250v, SLO-BLO (230 v)	
F201	2110-0040	Fuse: Cartridge, 1/16 A, 250v, SLO-BLO	
J100		Part of AT100	
J200	1251-0043	Connector, Female: 8 Pin, Polarized	
J201, 202	1250-0211	Connector: BNC UG-625A/U	
L101-106		Coil, Turret: Part of Z100	
L107		Part of AT100	
L108		Coil RF: Special	
L109, 110	03200-80002	Choke, RF: 80 μ h	
L112	03200-80002	Choke, RF: 80 μ h	
L113	03200-80001	Choke, RF: 17 μ h	
L114, 115	00225-80001	Coil, RF: 410 μ h	
L116	03200-80022	Coil, RF: 140 μ h	
P200	1251-0133	Connector, Male: 8 Pin, Polarized	
P204	1251-0148	Connector: AC power cord receptacle	

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description	Note
Q300	1850-0098	Transistor: 2N458, PNP	
Q301, 302	1853-0016	Transistor: 2N3638, PNP	
Q303	1850-0038	Transistor: 2N554, PNP	
Q401	1853-0036	Transistor: 2N3906, PNP	
R101-106	0686-1015	R: fxd, comp, 100 ohm, 5%, 1/2 w	
R107, 108	0686-2235	R: fxd, comp, 22K ohm, 5%, 1/2 w	
R109	0683-3315	R: fxd, comp, 330 ohm, 5%, 1/4 w	
R110-112	0683-1015	R: fxd, comp, 100 ohm, 5%, 1/2 w	
R113	0686-2205	R: fxd, comp, 22 ohm, 5%, 1/2 w	
R114	0683-1015	R: fxd, comp, 100 ohm, 5%, 1/4 w	
R118	0758-0002	R: fxd, met ox, 560 ohm, 5%, 1/2 w	
R119	0686-2205	R: fxd, comp, 22 ohm, 5%, 1/2 w	
R201	0686-6835	R: fxd, comp, 68K ohm, 5%, 1/2 w	
R202	0698-3635	R: fxd, met ox, 680 ohm, 10%, 2 w	
R203	2100-1461	R: var, 1 K ohm, 2 w includes S200	
R204	0698-3631	R: fxd, met ox, 330 ohms, 10%, 2 w	
R205	0686-5125	R: fxd, comp, 5.1K ohm, 5%, 1/2 w	
R300	0686-1015	R: fxd, comp, 100 ohm, 5%, 1/2 w	
R301	0686-7535	R: fxd, comp, 75 K ohms, 5%, 1/2 w	
R302	0698-0030	R: fxd, met ox, 510 ohms, 5%, 2 w	
R303	0686-6815	R: fxd, comp, 680 ohms, 5%, 1/2 w	
R304	0686-4725	R: fxd, comp, 4.7 K ohm, 5%, 1/2 w	
R305	0686-2225	R: fxd, comp, 2.2 K ohm, 5%, 1/2 w	
R306	2100-0154	R: var, 1 K ohm, 30%, 0.15 w	
R307	0686-3315	R: fxd, comp, 330 ohm, 5%, 1/2 w	
R308	0686-6825	R: fxd, comp, 6.8 K ohms, 5%, 1/2 w	
R309	0686-1215	R: fxd, comp, 120 ohm, 5%, 1/2 w	
R310	0761-0070	R: fxd, met ox, 8.2 K ohm, 5%, 1 w	
R401	0758-0098	R: fxd, met ox, 220 K ohm, 5%, 1/2 w	
R402, 403	0758-0003	R: fxd, met ox, 1 K ohm, 5%, 1/2 w	
S101	03200-00010	Spring, Contact: S101	
S200		Part of Resistor R203	
S201	3101-0033	Switch, Slide: DPDT	
S202	3101-0192	Switch, Slide: DP, 3 pos	
V100, 101	1921-0034	Electron tube: 6DZ4	
V300	1940-0004	Electron tube: OA2	
W200	8120-0078	Power Cord	
Z100	03200-60004	Turret Assembly	
Z300	03200-60001	Printed Circuit Board (with components): Power Supply	
Z400	03200-60027	Printed Circuit Board (with components): Pulse Modulation	

Table 6-2. Table of Replaceable Parts

Stock No.	Description	Mfg.	Mfg. Part No.	TQ	RS
0121-0101	C: var, 3.5-31.5 pf			1	1
0132-0002	C: var, trimmer 0.7-3.9 pf	72982	535-015-4R	1	1
0140-0054	C: fxd, mica, 100 pf, 10%, 500vdcw	53021	RCM15E101K	1	1
0160-0345	C: fxd, feedthru, 1000 pf, 500vdcw	01121	FB2B-102W	2	1
0160-0415	C: fxd, cer, feedthru, 100 pf, 500vdcw	01121	FA5C	1	1
0160-0434	C: fxd, cer, 10 pf, 10%, 500vdcw	72982	301000 COGO 100B	2	2
0160-0480	C: fxd, feedthru, 1000 pf, 500vdcw	01121	FA5C	2	2
0160-0492	C: fxd, mylar, 1.0 μ f, 10%, 200vdcw			1	1
0160-0919	C: fxd, cer, 10 pf, 10%, 150vdcw	Glenco	TC-150-C-10-K	2	1
0160-0952	C: fxd, mica, 220 pf, 1%, 500vdcw			1	1
0160-2006	C: fxd, mica, 100 pf, 10%, 500vdcw			1	1
0160-2162	C: fxd, feedthru, 100 pf, 20%, 500vdcw	01121	FB2B-1012	1	1
0160-2163	C: fxd, paper, feedthru, .47, 20%, 100vdcw	56289	102P36	1	1
0170-0024	C: fxd, my, .022 μ f, 20%, 200vdcw	56289	192P22302A	1	1
0170-0040	C: fxd, my, 0.04 μ f, 10%, 200vdcw	56289	192P47392A	1	1
0180-0295	C: fxd, elect, 40 μ f, 150vdcw	14655	BR-40-150V	1	1
0180-0345	C: fxd, elect, 2000 μ f, 25vdcw	14655	BR-2000-25V	1	1
0180-1748	C: fxd, elect, 45 μ f, 250vdcw	56289	39D456F250FL4	1	1
0340-0098	Standoff: Teflon	UST	G-4777-10	1	
0340-0105	Feedthru	98291	FT-SM-5	3	
0360-0393	Terminal	71785	1513	1	
0360-0446	Standoff: S101 contacts	98291	ST-SM-5	2	
0370-0026	Knob: RF VERNIER			1	
0370-0050	Handle, knob: P/O 0370-0149			1	
0370-0111	Knob: P/O 0370-0149			1	
0370-0112	Knob: RANGE Switch			1	
0370-0149	Knob Assy: FREQUENCY			1	
0380-0316	Standoff			2	
0380-0317	Spacer: RF tube shelf			2	
0510-0123	Clip, Retaining: 5/16" shaft	78553	C12008-014-4	1	
0510-0221	Nut, Retained: #6-32, cover retaining	78553	C8020-632-4	4	
0510-0235	Ring, Retaining: 3/8" shaft	79136	5133-37	1	
0510-0296	Roll Pin: Detent Wheel			1	
0590-0010	Nut, Acorn: #8-32, Transformer Retaining			4	
0590-0111	Nut, Pushon: 1/8" dia shaft	78553	C1037-010-24	4	
0683-1015	R: fxd, comp, 100 ohm, 5%, 1/4 w	01121	CB1015	4	2
0683-3315	R: fxd, comp, 330 ohm, 5%, 1/4 w	01121	CB3315	1	1
0686-1015	R: fxd, comp, 100 ohm, 5%, 1/2 w	01121	EB-1015	7	2
0686-1215	R: fxd, comp, 120 ohm, 5%, 1/2 w	01121	EB-1215	1	1
0686-2205	R: fxd, comp, 22 ohm, 5%, 1/2 w	01121	EB-2205	2	2
0686-2225	R: fxd, comp, 2.2K ohm, 5%, 1/2 w	01121	EB-2225	1	1
0686-2235	R: fxd, comp, 22K ohm, 5%, 1/2 w	01121	EB-2235	2	2
0686-3315	R: fxd, comp, 330 ohms, 5%, 1/2 w	01121	EB-3315	1	1
0686-4725	R: fxd, comp, 4.7 K ohm, 5%, 1/2 w	01121	EB-4725	1	1
0686-5125	R: fxd, comp, 5.1K ohm, 5%, 1/2 w	01121	EB-5125	1	1

Table 6-2. Table of Replaceable Parts (Cont'd)

Stock No.	Description	Mfg.	Mfg. Part No.	TQ	RS
0686-6815	R: fxd, comp, 680 ohms, 5%, 1/2 w	01121	EB-6815	1	1
0686-6825	R: fxd, comp, 6.8 K ohms, 5%, 1/2 w	01121	EB-6825	1	1
0686-6835	R: fxd, comp, 68 K ohm, 5%, 1/2 w	01121	EB-6835	1	1
0686-7535	R: fxd, comp, 75 K ohms, 5%, 1/2 w	01121	EB-7535	1	1
0698-0030	R: fxd, met ox, 510 ohms, 5%, 2 w	07115	C 42S	1	1
0698-3635	R: fxd, met ox, 680 ohm, 10%, 2 w	07115	C-42	1	1
0698-3631	R: fxd, met ox, 330 ohms, 10%, 2 w	07115	C 42S	1	1
0758-0002	R: fxd, met ox, 560 ohm, 5%, 1/2 w	07115	C 5	1	1
0758-0003	R: fxd, met ox, 1 K ohm, 5%, 1/2 w	07117	C 5	2	2
0758-0098	R: fxd, met ox, 220 K ohm, 5%, 1/2 w	07115	C 5	1	1
0761-0070	R: fxd, met ox, 8.2 K ohm, 5%, 1 w	07115	C 32	1	1
1200-0077	Insulator: Transistor			2	
1200-0116	Socket, Transistor	91506	8038-1G1	2	
1250-0211	Connector: BNC UG-625A/U	95712	667-6	2	1
1251-0043	Connector, Female: 8 Pin, Polarized	71785	261-32-08-010	1	
1251-0133	Connector, Male: 8 Pin, Polarized	71785	261-31-08-031	1	
1251-0148	Connector: AC power cord receptacle	87930	H-1061-2	1	
1400-0084	Fuse Holder	75915	342014	1	
1410-0033	Bushing, Knob: P/O 0370-0149			1	
1410-0156	Bearing: Bronze, 1/4" ID			1	
1450-0048	Light, Indicator	72765	599-124	1	
1460-0154	Spring, Dial Cord			1	
1460-0209	Spring, Leaf: Detent			1	
1460-0225	Spring, Attenuator			1	
1490-0032	Tilt Stand			1	
1500-0044	Drive, Vernier: Frequency Shaft			1	
1530-0061	Insert, Threaded: Phenolic			4	
1850-0038	Transistor: 2N554, PNP			1	1
1850-0062	Transistor: 2N404, PNP			1	1
1850-0098	Transistor: 2N458, PNP			1	1
1853-0016	Transistor: 2N3638, PNP			2	2
1853-0036	Transistor: 2N3906, PNP			1	1
1901-0029	Diode: Si, 600 Piv, 0.5a			2	2
1901-0049	Diode: Si, 50 Piv, 0.5a			6	6
1902-0186	Diode: Avalanche, 32.4 v, 5%, 400mw			1	1
1921-0034	Electron tube: 6DZ4			2	2
1940-0004	Electron tube: OA2			1	1
2100-0154	R: var, 1 K ohm, 30%, 0.15 w			1	1
2100-1461	R: var, 1 K ohm, 2 w, includes S200			1	1
2110-0008	Fuse: Cartridge, 1/2 A, 250v, SLO-BLO(115 v)	71400	MDL 1/2	1	10
2100-0018	Fuse: Cartridge, 1/4 A, 125v, SLO-BLO(230 v)	71400	MDL 1/4	1	10
2110-0040	Fuse, Cartridge, 1/16 A, 250v, SLO-BLO	71400	MDL 1/16	1	10
2190-0047	Lockwasher, Conical: Frame Assembly			16	
2190-0130	Wash, Shoulder: Nylon			2	
2370-0016	Screw, Mach: #6-32 x 5/16 FH, Frame Assembly			16	
2370-0020	Screw, Mach: #6-32 x 3/16 FH, Cover Retaining			8	

Table 6-2. Table of Replaceable Parts (Cont'd)

Stock No.	Description	Mfg.	Mfg. Part No.	TQ	RS
2410-0001	Screw, Mach: #6-32 x 5/8 OH SS P/O 0370-0149			1	
3101-0192	Switch, Slide: DP, 3 pos	79727	G-128-L	1	1
3101-0033	Switch, Slide: DPDT	42190	4633	1	1
5000-0703	Cover, Side			2	
5000-0717	Cover, Bottom			1	
5000-3001	Spring, Detent			1	
5040-0147	Insulator			1	
5040-0700	Hinge: Tilt stand			2	
5040-1601	Detent Wheel: Nylon			1	
5060-0703	Frame Assembly, Slide			2	
5060-0720	Cover, Top			1	
5060-0728	Foot Assembly			2	
6040-0024	Grease, Lubricating: Molykote "G "				
8120-0078	Power Cord	70903	KH-4147	1	1
8160-0021	Braid, RF Shield: 24" approx.				
8160-0050	Cord, Dial: 4 ft. required				
8500-0059	Compound, Silicon: For transistor insulators, 8 oz. tube				
9100-0314	Transformer, Power			1	1
9170-0123	Slug: Ferrite Tuning: L101-104	IGC	F610	4	
00225-20015	Plug: Threaded			1	
00225-80001	Coil, RF: 410 μ h			2	2
00225-80007	Nut, Hex: #2, Silver Plated			2	
00230-20065	Roller, Detent			1	
00230-80035	Lockwashers: #2, Silver Plated			2	
03200-00004	Can, Shield			1	
03200-00005	Trimmer, Minimum "C"			2	
03200-00010	Spring, Contact: S101			1	
03200-00011	Cursor			1	
03200-00017	Contact, Turret: Upper			1	
03200-00018	Contact, Turret: Lower			1	
03200-00021	Panel, Upper Front			1	
03200-00022	Panel, Rear			1	
03200-00023	Upper Panel Support			1	
03200-00024	Can, Shield: Top			1	
03200-00025	Plate, Switch			1	
03200-00027	Panel, Lower Front			1	
03200-20007	Counter Shaft			1	
03200-20008	Rod, Cursor Guide			2	
03200-20009	Ring, Locking: Attenuator			1	

Table 6-2. Table of Replaceable Parts (Cont'd)

Stock No.	Description	Mfg.	Mfg. Part No.	TQ	RS
03200-20011	Shaft, Turret			1	
03200-20013	Shaft, Dial			1	
03200-20014	Window, Front Panel			1	
03200-20019	Pin: Attenuator Locking			1	
03200-20025	Spur Gear			2	
03200-20026	Gear: Turret Shaft			1	
03200-20027	Gear: Countershaft			1	
03200-20041	Shaft, Frequency			1	
03200-20043	Collar: Attenuator Tube			1	
03200-20045	Spacer: Vernier Drive			1	
03200-60001	Printed Circuit Board (with components): Power Supply			1	
03200-60003	RF Tube Shelf: Includes tube skts, terminals, etc.			1	
03200-60004	Turret Assembly			1	
03200-60011	Attenuator Probe			1	
03200-60018	Pulley and Bracket Assembly			3	
03200-60019	Pulley and Bracket Assembly			1	
03200-60024	Pulley Assembly: Includes C117			1	
03200-60027	Printed Circuit Board (with components): Pulse Modulation			1	
03200-80001	Choke, RF: 17 μ h			1	
03200-80002	Choke, RF: 80 μ h			3	1
03200-80012	Ring, Retaining: Attenuator Pin			1	
03200-80014	Stop, Cursor: Rubber			1	
03200-80016	Mask, Window			1	
03200-80022	Coil, RF: 140 μ h			1	1



ILLUSTRATED PARTS IDENTIFICATION

MODEL 3200B

VHF OSCILLATOR

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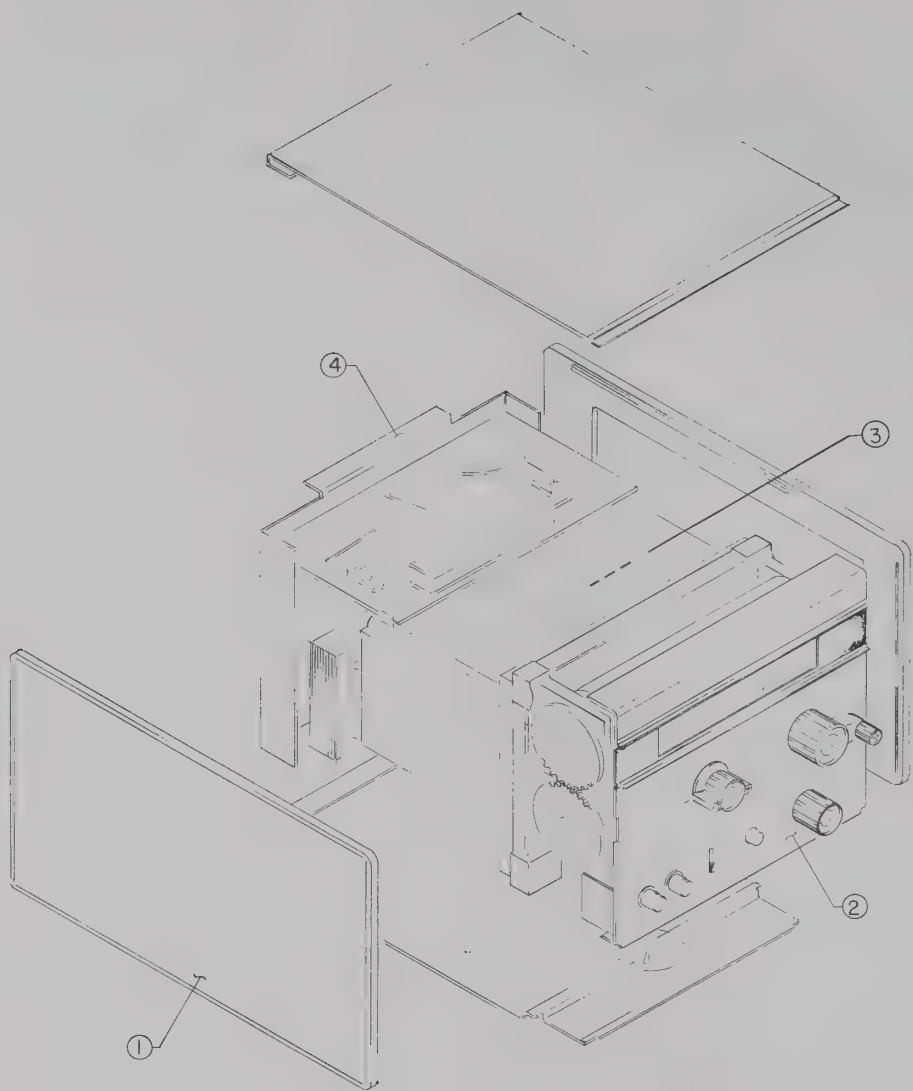


Figure 1. -hp- 3200B VHF Oscillator, General Arrangement

Ref	Illustration
1	See Figure 2, Cabinet Parts
2	See Figure 3, Front Section and Panel Assembly
3	See Figure 4, RF Oscillator Compartment
4	See Figure 5, Rear Section and RF Compartment Cover

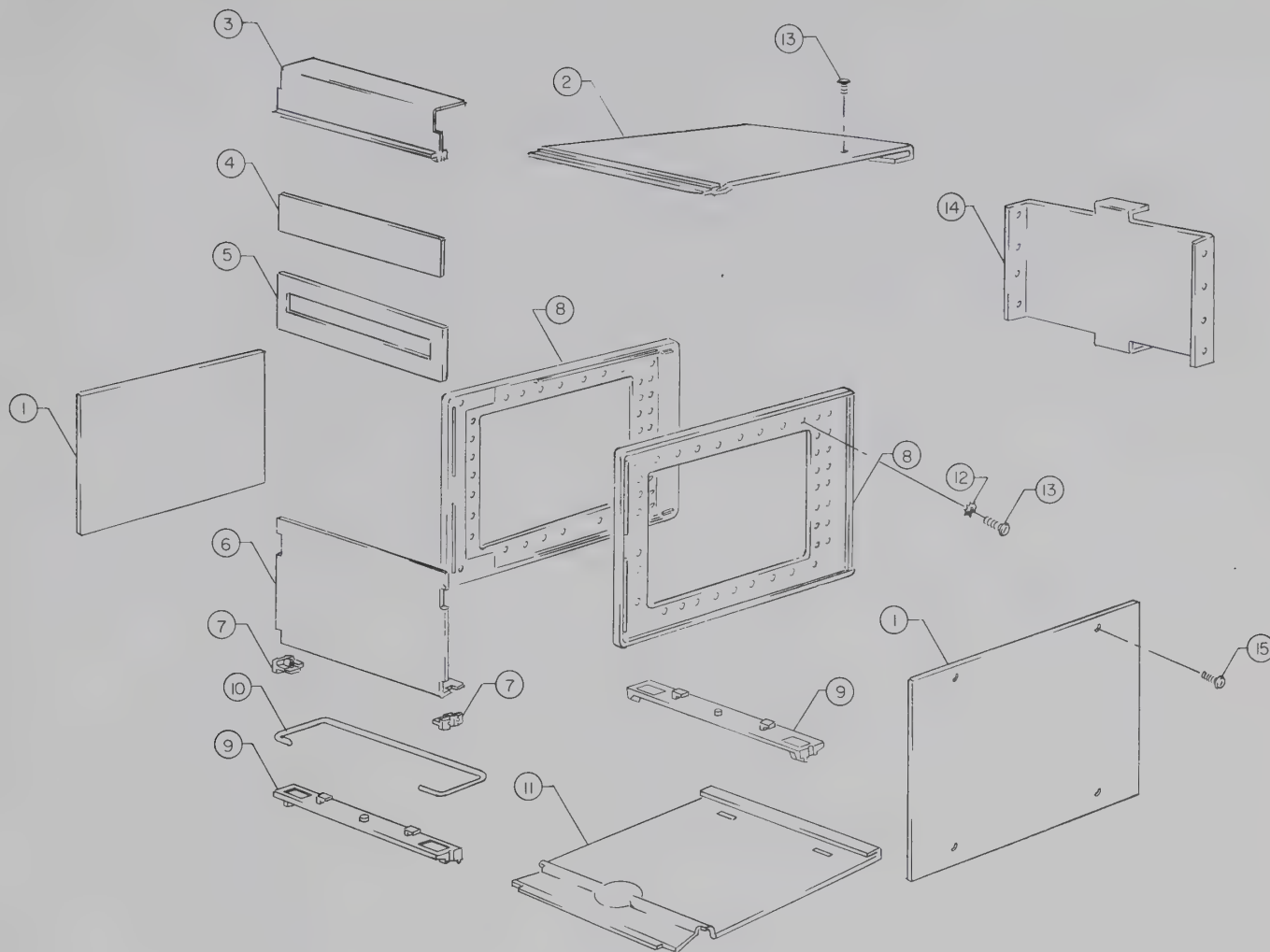


Figure 2. -hp- 3200B VHF Oscillator, Cabinet Parts

Ref	Part No.	Description	Qty
1	5000-0703	Cover, side	2
2	5060-0720	Cover, top	1
3	03200-00021	Panel, upper front	1
4	03200-00014	Window, front panel	1
5	03200-80016	Mask, window	1
6	03200-00027	Panel, lower front	1
7	5040-0700	Hinge	2
8	5060-0703	Frame assy, side	2
9	5060-0728	Foot assy	2
10	1490-0032	Stand, tilt	1
11	5000-0717	Cover, bottom	1
12	2190-0047	Washer, lock, conical, ext, #6	12
13	2370-0016	Screw, mach, 6-32 x 5/16 FH	16
14	03200-00022	Panel, rear	1
15	2370-0020	Screw, mach, 6-32 x 3/16 FH	8

Ref.	Stock No.	Description	Qty.	Ref.	Stock No.	Description	Qty.
1	03200-20025	Gear, spur	2	34	2630-0009	Screw, mach, brs, 8-32 x 3/8 BH SD NP	1
2	0510-0294	Pin, spring, stl, 1/16 D x 11/16 L	3	35	03200-20027	Gear, miter: counter shaft	1
3	03200-20007	Shaft: counter	1	36	0510-0717	Clamp, cable, flattened loop	1
4	2295-0006	Screw, mach, brs, 4-40 x 1/4 BH SD NP	8	37	3050-0066	Washer, flat, brs, 3/8 OD	1
5	2190-0004	Washer, lock, int #4	8	38	03200-20042	Plate, frequency & range shaft	1
6	03200-60019	Pulley and bracket assy	1	39	2550-0008	Screw, mach, ss, 6-32 x 1/2 BH SD	2
7	03200-20040	Base plate	1	40	1410-0156	Bearing, sleeve, brz	1
8	3030-0117	Screw, set, 8-32 x 1/4 skt hd cup pt	1	41	2950-0001	Nut, hex, brs, 3/8-32 x 1/2 NP	1
9	03200-20030	Drum dial, frequency	1	42	03200-00025	Plate, switch	1
10	03200-20013	Shaft, dial	1	43	2190-0016	Washer, lock, int, ph brz, 1/2 OD, 3/8 ID	1
11	3050-0316	Washer, spring, 13/16 OD	2	44	0510-0123	Fastener, push-on for 5/16 std	1
12	3050-0274	Washer - flat, brs, 3/4 OD	2	45	2100-1461	R: var, comp, 1K Ω (R203)	1
13	0510-0235	Ring, retaining, for 3/8 shaft	1	46	0360-0380	Terminal, solder, brz, .398 hole x 1-33/64 L	1
14	0590-0111	Nut, push-on, stl, 1/2 OD	4	47	03200-00023	Upper panel support	1
15	03200-20008	Guide rod, cursor	2	48	03200-00021	Panel, upper front	1
16	03200-20041	Shaft, frequency	1	49	03200-20014	Window, front panel	1
17				50	03200-80016	Mask, window	1
18	2190-0008	Washer, lock, ext #6	1	51	03200-00027	Panel, lower front	1
19	3030-0009	Screw, set, 6-32 x 3/8 skt hd cup pt	1	52	1490-0032	Stand, tilt, 7.088 L x 2.236 H	1
20	1500-0044	Drive, vernier, frequency shaft	1	53	5040-0700	Hinge	2
21	1480-0190	Pin, roll	1	54	3101-0192	Switch, slide, DP3 POS (S202)	1
22	0510-0296	Pin, roll: detent wheel	1	55	1250-0211	Connector: BNC panel mtg (J201, 202)	2
23	5040-1601	Wheel, detent	1	56	1450-0048	Light, indicator, red (DS200)	1
24	03200-20026	Gear, miter: turret shaft	1	57	0370-0112	Knob, skirted, bar, 3/4 D, 1/4 shaft	1
25	03200-60018	Pulley and bracket assy	3	58	3030-0117	Screw, set, 8-32 x 1/4 cp pt	6
26	0350-0393	Standoff, 1 lug	1	59	0370-0026	Knob, round, 3/4 D, 1/4 shaft, w/arrow	1
27	2470-0001	Screw, mach, brs, 6-32 x 1/4 BH SD NP	2	60	0370-0149	Knob and crank assy	1
28	03200-80014	Cursor stop	1	61	0370-0111	Knob, crank 1 D, 1/4 shaft	1
29	03200-00011	Cursor	1	62	1410-0033	Bushing, knob, .219 OD	1
30	00230-20065	Roller, detent	1	63	0370-0050	Knob, round, 3/8 OD x .525 L	1
31	5000-3001	Spring, detent	1	64	2410-0001	Screw, mach, ss, 6-32 x 5/8 OH	1
32	606A-91B	Spring, leaf	1	65	2370-0016	Screw, mach, ss, 6-32 x 5/16, FH 1000	1
33	2190-0010	Washer, lock, ext #8	2	66	2190-0047	Washer, lock, conical, ext, #6, NP	1

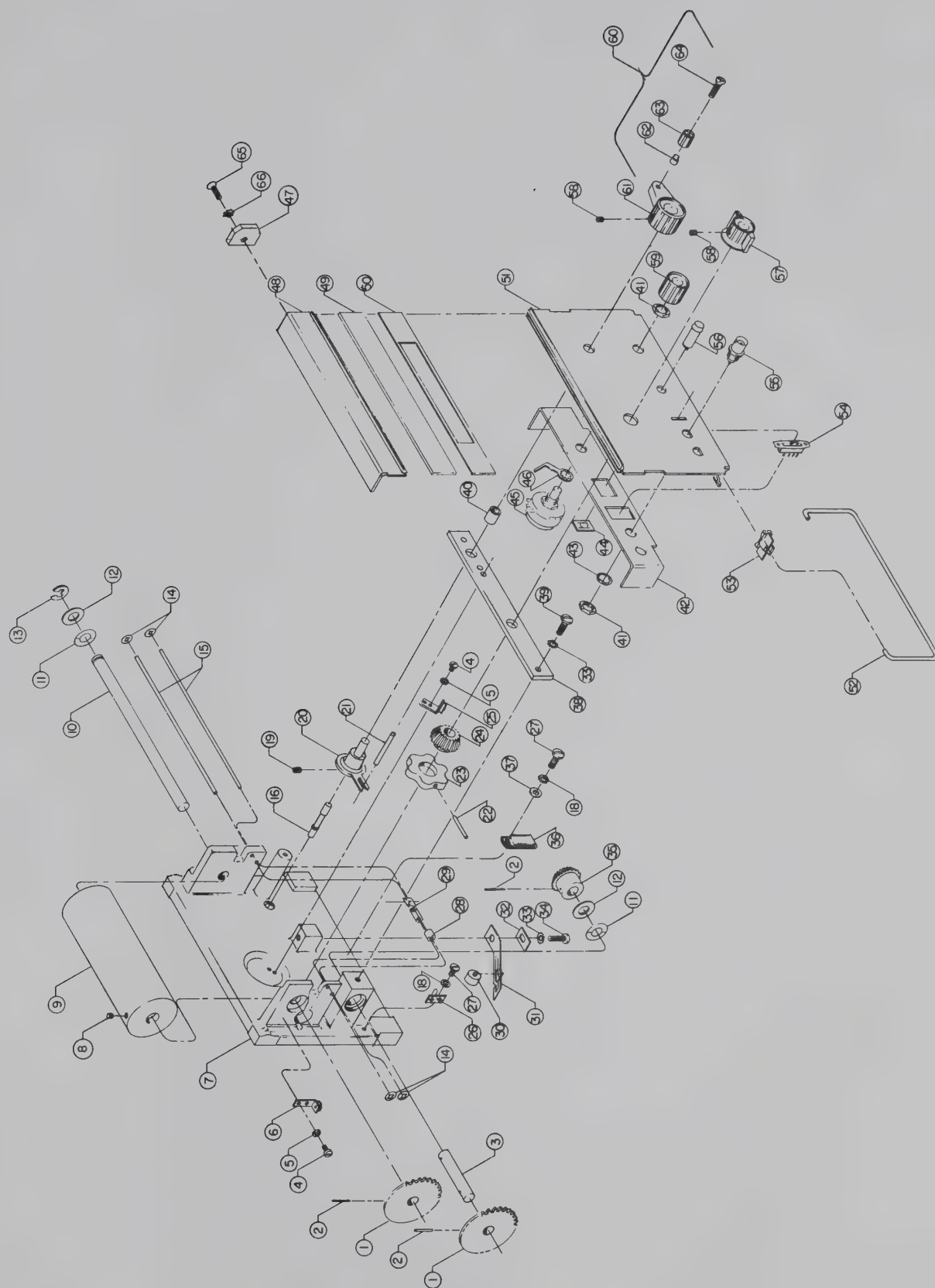


Figure 3. -hp- 3200B VHF Oscillator, Front Section and Panel Assembly

Ref.	Stock No.	Description	Qty.	Ref.	Stock No.	Description	Qty.
1	03200-20040	Base plate-casting	1	31	5040-0147	Insulator	1
2	2190-0088	Washer, lock, (P/09)	1	32	2820-0001	Nut, hex, brs, 10-32 x 3/8 NP	1
3	2950-0027	Nut, hex, brs, 5/16-32 x 7/16 CP (P/09)	1	33	0160-0345	C: fxd, cer, 1000 pF 500 vdcw (C112, 113)	2
4	2732-0008	Screw, mach, ss, 10-32 x 5/8 BH PHD	4	34	0160-2162	C: fxd, cer, 100 pF 500 vdcw (C114)	1
5	2190-0012	Washer, lock, ext, #10	2	35	2500-0005	Nut, hex brs, 6-32 x 1/4 x 7/64 NP	4
6	0350-0270	Lug, solder, ph brz, int tooth, #10	2	36	2190-0008	Washer, lock ext, #6	2
7	2700-0009	Screw, mach, ss, 10-32 x 1-1/2 PAN H, SD	2	37	03200-60027	Printed board assy pulse mod (Z400)	1
8	2190-0012	Washer, lock, ext, #10	3	38	2190-0007	Washer, lock, int, #6	3
9	0160-2163	C: fxd, paper, .47μF ±20%, 100 vdcw (C122)	1	39	0132-0002	C: var, poly, 0.7 -3 pF (C108)	1
10	0380-0316	Standoff, alum, 10-32 thrd, 3/8 OD x 1-3/4 lg	2	40	0360-0458	Lug, solder, cpr, non-locking, #2	1
11	0380-0317	Spacer, -alum, 3/8 OD x 1/4 lg	2	41	0520-0039	Screw, mach, brs, 2-56 x 1/8 BH SD NP	3
12	3050-0316	Washer, spring, 13/16 OD	1	42	03200-80010	Socket, tube, NFR, P/O Ref 46	2
13	3050-0274	Washer, flat, brs, 3/4 OD	1	43	0340-0105	Feedthru, insul, 0.515 lg	3
14	0610-0002	Nut, hex, brs, 2-56 x 3/16 x 1/16 NP	2	44	03200-00010	Contact, grid switch, (P/O S101)	1
15	2190-0014	Washer, lock, int, #2	2	45	0360-0446	Terminal, standoff, press-in, .350 lg (P/O S101)	2
16	0340-0098	Terminal, standoff, .475 lg teflonins	1	46	2765-0006	Screw, mach, brs, 10-32 x 3/4 BH SD NP	2
17	0510-0060	Ring, grip, for 3/8 shaft	1	47	03200-60003	RF Tube Shelf Assy, with components, less Ref 36	1
18	0360-0390	Lug, solder, brs, non-locking, #2	3	48	03200-20011	Shaft, turret, fiberglass	1
19	0121-0101	C: var, 3.5 to 31.5 pF (C103 A,B)	1	49	2470-0013	Screw, mach, brs, 6-32 x 3/8 BH SD NP	2
20	0360-0037	Lug, solder, copper, ring type	3	50	03200-20021	Insulator, grid switch NRFR, P/O 46	2
21	2470-0013	Screw, mach, brs, 6-32 x 3/8 BH SD NP	2	51	03200-00017	Contact, right (near pulley)	1
22	2360-0002	Screw, ss, 6-32 x 3/16 RH	1	52	03200-00018	Contact, left	1
23	03200-60024	Pulley assy	1	53	00230-80035	Washer, lock, helical, ph brz, #2 SP	2
24	3030-0117	Screw, set, 8-32 x 1/4 cup pt skt bd	1	54	00225-80007	Nut, hex, brs, 2-56 x 1/8 x 3/64 SP	2
25	03200-00004	Can, shield, bottom	1	55	2190-0110	Washer, fibre, #8	2
26	0160-0480	C: fxd, cer, 1000 pF 500 vdcw (C109, 110)	2	56	03200-00019	Contact spring	1
27	0160-0415	C: fxd, cer, 100 pF 500 vdcw (C111)	1	57	2190-0130	Washer, shoulder, nylon	2
28	3050-0293	Washer, fish paper, 3/16 ID	4	58	0520-0052	Screw, mach, brs, 2-56 x 3/8 BH SD NP	2
29	0890-0294	Sleeving, transflex #5	1 1/8	59	3030-0002	Screw, set, 8-32 x 3/8 skt hd	2
30	00225-80001	Coil, RF choke, (L114, 115)	2	60	9170-0123	Slug: ferrite, threaded (P/O 59) (P/O L101-104)	4
	03200-80022	Coil, RF choke (L116)	1		03200-60004	Turret assy	4
	03200-00024	Can, shield, top	1		1530-0061	Insert, internal thread, phenolic paper (P/O 59)	4
		NOT SHOWN	4		2765-0005	Screw, mach, brs, 10-32 x 5/8 BH SD NP	2
	8160-0050	Dial Cord	1			+ on some instruments these contacts are soldered which eliminates Ref. 51 and 52.	
	1460-0154	Spring, Dial Cord	1				

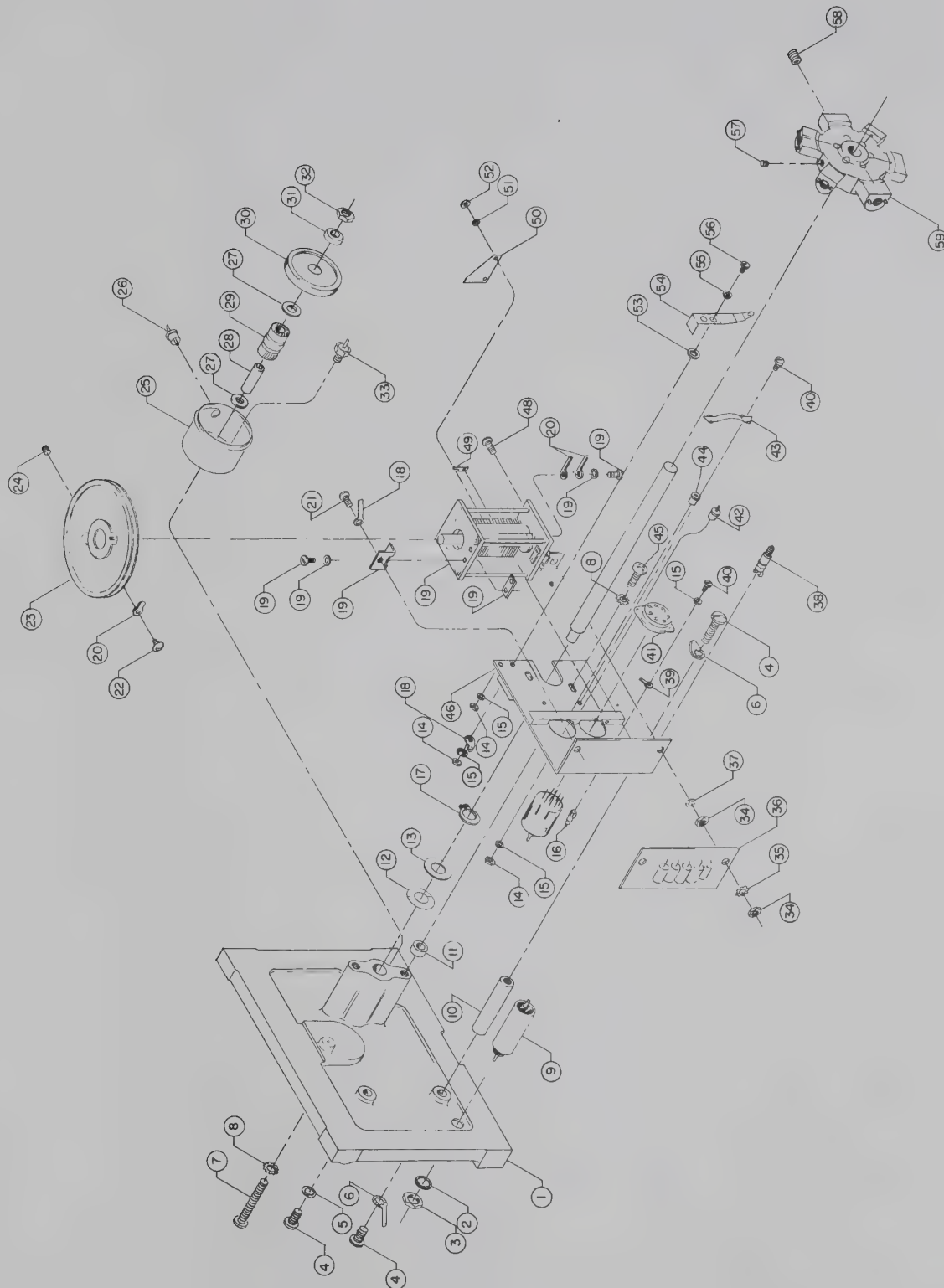


Figure 4. -hp- 3200B VHF Oscillator, RF Oscillator Compartment

Ref.	Stock No.	Description	Qty.
1	03200-60011	Attenuator probe (AT100)	1
2	1400-0084	Holder, fuse (includes 3, 15, 16)	1
3	1400-0090	Washer, flat, neoprene, 1/2 ID	1
4	2390-0025	Screw, mach, ss, 6-32 x 1" BH SD	2
5	2390-0051	Screw, mach, ss, 6-32 x 1-1/8 BH SD	3
6	0510-0221	Nut, retained, 6-32	6
7	0590-0010	Nut, cap, 8-32	4
8	2190-0009	Washer, lock, int, #8	4
9	2470-0001	Screw, mach, BRS, 6-32 x 1/4 BH SD NP	1
10	2190-0007	Washer, lock, int, #6	6
11	03200-00022	Panel, rear	1
12	0380-0145	Spacer, alum, 3/8 OD x 3/4 lg	4
13	3050-0001	Washer, brass, 3/8 OD	var
14	9100-0314	Transformer, power	1
15	2190-0031	Washer, lock, int, .5291D	1
16	2950-0038	Nut, hex, 1/2-24 x 11/16	1
17	00202-20034	Spacer, sleeve, 3/4 lg	2
18	1251-0043	Connector, female, 8 contact (J200)	1
19	2500-0005	Nut, hex, BRS, 6-32 x 1/4 x 7/64 NP	5
20	0360-0365	Terminal, solder, int tooth, #6	1
21	1251-0133	Connector, male, 8 contact (P200)	1
22	03200-60001	Printed circuit board w/components (Z300)	1
23	3101-0033	Switch, slide, DPDT (S201)	1
24	1251-0148	Connector: power (P204)	1
25	03200-20009	Ring, locking: attenuator	1
26	1460-0225	Spring, attenuator locking	1
27	03200-80012	Ring, retaining: attenuator pin	1
28	03200-20019	Pin: attenuator locking	1
29	1200-0077	Insulator, transistor	2
30	1200-0116	Socket, transistor, for TO-3 case	
31	2190-0084	Washer, lock, int, spr stl	4
32	2440-0011	Screw, mach, BRS, 6-32 x 3/8 RH SD NP	4
33	03200-20003	Shield, cover	1
34	00225-20015	Plug, threaded, silverplated	1
35	2732-0008	Screw, mach, ss, 10-32 x 5/8 BH PHD	4
36	2190-0091	Washer, lock, helical phs brz #10	
37	8160-0021	Braid, RF, brass, 1/8 D 21"	4

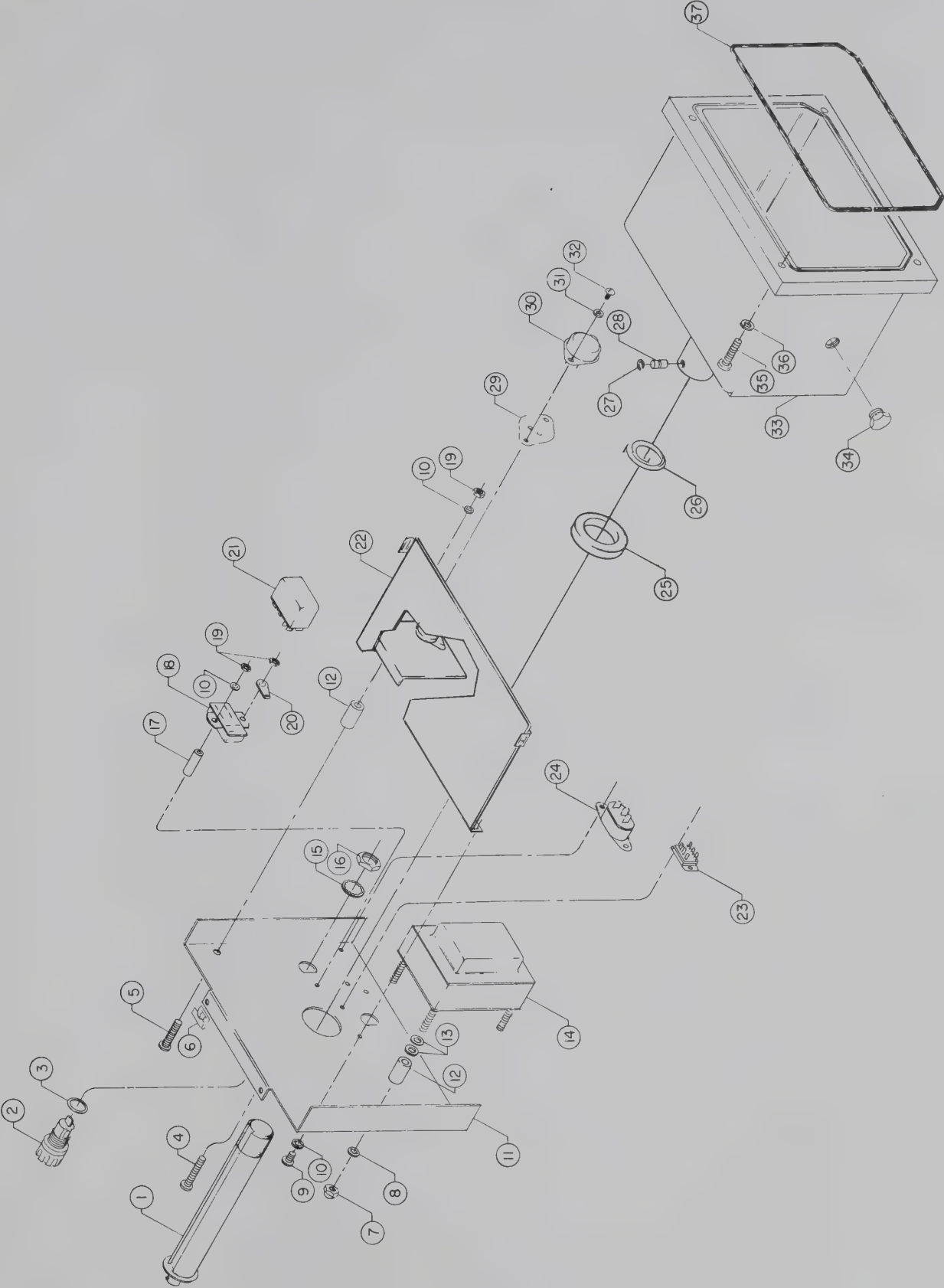


Figure 5. -hp- 3200B VHF Oscillator, Rear Section and RF Compartment Cover

APPENDIX 1 - MANUAL CHANGES

This manual applies directly to 3200B VHF Oscillators having serial number prefix 626. This manual with the following changes applies to 3200B VHF Oscillators having serial prefix numbers 534, 604, and 622.

To adapt this manual to instruments with serial number prefixes other than 626 make changes as follows:

Instrument Serial No. Prefix	Change No.
622	1
604, 534	1, 2

CHANGE #1:

Page 5-9, Fig. 5-12. Schematic R305 change to 2.7K. Transistor complement: Change Q301 to 1850-0070, 2N1373. Change Q302 to 1850-0062, 2N404.

Page 6-3, Table 6-1. Change Q301 from 1853-0016 Transistor, Si, 2N3638, PNP to 1850-0070 Transistor, Ge, 2N1373, PNP. Change Q302 from 1853-0016 Transistor, Si, 2N3638 PNP to 1850-0062 Transistor, Ge, 2N404. Change R305 from 0686-2225 R: fxd, comp, 2.2K ohm, 5%, 1/2 watt to 0686-2725 R: fxd, comp, 2.7K ohm, 5%, 1/2 watt.

Page 6-4, Table 6-2. Add Part No. 0686-2725 R: fxd, comp, 2.7K ohm, 5%, 1/2 watt. Delete Part No. 0686-2225.

Page 6-5, Table 6-2. Add Part No. 1850-0070 Transistor, Ge, 2N1373, PNP and Part No. 1850-0062 Transistor, Ge, 2N404, PNP. Delete Part No. 1853-0016

CHANGE #2:

Page 1-0, Table 1-1. SPECIFICATIONS. Pulse Modulation - External requirements. Change "2.5" volts to "1" volt negative pulse into 2000 ohms.

Page 5-9, Fig. 5-12. Schematic R205 changed to 10K. Transistor complement Change Q401 to 1850-0070, 2N1373.

Page 6-3, Table 6-1. Change Q401 from 1853-0036 Transistor, Si, 2N3906, PNP to 1850-0070 Transistor, Ge, 2N1373, PNP. Change R205 from 0686-5125 R: fxd, comp, 5.1K ohm, 5%, 1/2 watt to 0758-0006 R: fxd, met ox, 10K ohm, 5%, 1/2 watt.

Page 6-4, Table 6-2. Delete Part No. 0686-5125.

Page 6-5, Table 6-2. Add Part No. 0758-0006 R: fxd, met ox, 10K ohm, 5%, 1/2 w. Change TQ Part No. 1850-0070 from 1 to 2. Delete Part No. 1853-0036.

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OPERATING AND SERVICE MANUAL

VHF OSCILLATOR

3200B



HEWLETT  PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from date of delivery, or in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

For any assistance contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.



MANUAL CHANGES

MODEL: 3200B

Manual Serial Prefixed: 735

HP Part No.: 03200-90026

To adapt this manual to instruments with other serial prefixes check for errata below, and make changes shown in tables.

Instrument Serial Prefix	Make Manual Changes	Instrument Serial Prefix	Make Manual Changes
All	1, ERRATA		
1034A-3401 to -0415	1, 2		
1215A-04151 Up	1, 2, 3		

Δ New or revised item.

ERRATA

Page 5-2, Table 5-1

Change: Diode Mixer to read General Radio type 874VR

Page 5-3, Figure 5-1

Change: Diode Mixer shown, to General Radio type 874VR

CHANGE 1.

Page 3-1, Paragraph 3-11.

Add:

NOTE

The attenuator probe couples power from the wide band oscillator and the following precautions must be observed:

1. The probe must not be completely inserted in the tube while the instrument is operated at the low end of the 260-500 MHz range. The loading on the oscillator could cause the oscillator to stop. In this condition the tubes could draw excessive current causing the B+ supply fuse to open.
2. Over coupling of the probe will cause loading on the oscillator which will lower the operating frequency of the oscillator.

Page 6-3, Table 6-1.

Change: R201 to 0686-4735 Resistor fixed 47KΩ ±5% 1/2w
V100, V101 to 1130-0701 Tube, electron 6DZ4

18 June 1970/
28 Oct. 71
25 April 72

MODEL: 3200B

page 2

CHANGE 2.

Page 6-2 thru 6-3, Table 6-1.

Change:	DS200	to	1450-0419	Light, ind white
	P204	to	1251-2357	Connector, ac power
	F200	to	2110-0202	0.5A fuse (115V)
	F200	to	2110-0201	0.25A fuse (230V)
	S201	to	3101-1234	Switch DPDT
	W200	to	8120-1348	Cable Assembly, ac

ERRATA

Page 1-0

Change: Amplitude Modulation, External
requirements to read: approximately 32 volts
RMS into 600 ohms for 30% AM

Page 3-1

Change: Para 3-14c to read: a modulation signal
of approximately 32 V RMS will result in 30%
amplitude modulation with less than 1% distortion.

Page 5-3

Change: Para. 5-16-e to read: The meter reading
shall be 32V $\pm 7V$.

Δ CHANGE 3.

The standard colors for this instrument are now mint gray (for front panel) and olive gray (for all other surfaces). Option X95 designates use of the former color scheme of light gray and blue gray. Option A85 designates use of a light gray front panel with olive gray used for all other external surfaces. New Part Numbers are shown below:

DESCRIPTION	HP PART NO.		
	STANDARD	Option A85	Option X95
Front Panel (upper)	03200-00041	03200-00021	Refer to Manual Parts List
Front Panel (lower)	03200-00042	03200-00027	
Top Cover	5060-8577	5060-8577	
Bottom Cover	5000-8583	5000-8583	
Side Cover	5000-8565	5000-8565	



OPERATING AND SERVICE MANUAL

MODEL 3200B VHF OSCILLATOR

SERIALS PREFIXED: 735

This manual applies directly to Model 3200B VHF Oscillators having serials prefixed 735. This manual with the notes provided in Section VII can be applied to Model having serials prefixed 534, 604, 622, 626, 708 and 731.

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Green Pond Road

Rockaway, New Jersey, U.S.A.

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Table 1-1. Specifications

Frequency range: 10 to 500 MHz in six bands: 10 to 18.8 MHz; 18.5 to 35 MHz; 35 to 68 MHz; 68 to 130 MHz; 130 to 260 MHz; 260 to 500 MHz.

Frequency accuracy: within $\pm 2\%$ after $\frac{1}{2}$ hour warmup.

Frequency calibration: increments of less than 4%.

Frequency stability (after 4-hour warmup under 0.2 mw load): short term (5 minutes) $\pm 0.002\%$; long term (1 hour) $\pm 0.02\%$; line voltage (5-volt change) $\pm 0.001\%$.

RF output:

Maximum power (across 50-ohm external load): >200 mw (10 to 130 MHz); >150 mw (130 to 260 MHz); >25 mw (260 to 500 MHz).

Range: 0 to >120 db attenuation from maximum output.

Load impedance: 50 ohms nominal.

RF leakage: sufficiently low to permit measurements at 1 μ v. **RFI:** meets requirements of MIL-I-6181D.

Amplitude modulation: externally modulated.

Range: 0 to 30%.

Distortion: <1% at 30% AM.

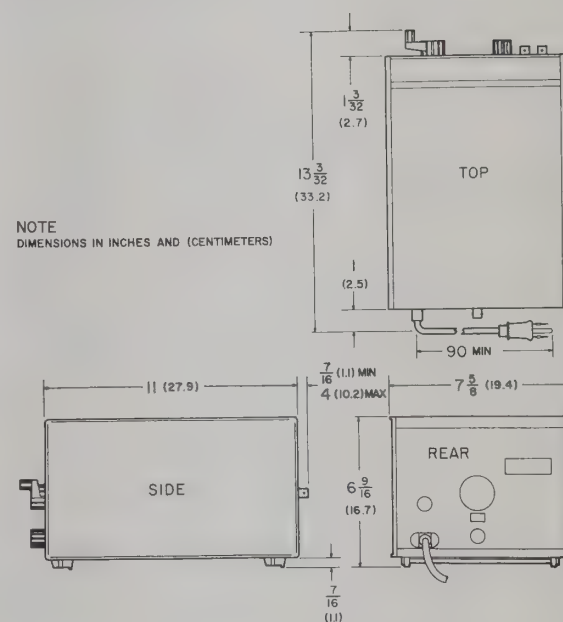
External requirements: approximately 20 volts rms into 600 ohms for 30% AM, 200 Hz to 100 kHz.

Pulse modulation: externally modulated.

External requirements: 2.5 volt negative pulse into 2000 ohms.

Power: 105 to 125 v or 210 to 250 v, 50 to 1000 Hz, 30 w.

Dimensions:



Weight: net 15 lbs. (6,8 kg), shipping 19 lbs. (8,6 kg).

Accessories available: 13515A Frequency Doubler
Probe: 00501B, 00514B, 00517B Output Cables;
00502B, 00506B Patching Cables.

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

1-2. The 3200B VHF Oscillator is designed for general purpose laboratory use in the frequency range of 10 to 500 MHz. Typical applications include: receiver and amplifier testing; driving bridges, slotted lines, antenna and filter networks; and use as a local oscillator for heterodyne detector systems. It is completely self-contained and housed in a modular cabinet which can be adapted for standard rack mounting.

1-3. A push-pull oscillator is housed in a rugged aluminum casting for maximum stability and extremely low leakage. Six frequency ranges are provided for adequate bandspread on the slide-rule dial. Amplitude and pulse modulation may be obtained by the use of suitable external sources. The RF output is coupled through a waveguide-below-cutoff variable attenuator. An electronic RF level vernier is included as a front panel control.

1-4. A solid-state power supply furnishes all necessary operating voltages, including dc to the os-

cillator tube heaters for minimum hum modulation and maximum tube life.

1-5. SUPPLEMENTARY EQUIPMENT

1-6. The -hp- 13515A Frequency Doubler Probe extends the frequency range of the 3200B up to 1000 MHz. In the frequency range from 500 to 1000 MHz, the power output will be in excess of 4 mW across an external 50 ohm load.

1-7. INSTRUMENT IDENTIFICATION

1-8. Hewlett-Packard uses a two-section, eight-digit serial number (on instrument rear panel) to identify instruments (000-00000). The first three digits are a serial prefix number, and the last five digits refer to a specific instrument. If the serial prefix on your instrument does not appear on the title page of this manual, there are differences between the manual and your instrument which are described in the Appendix or in a Manual Change Sheet included with the manual. If the change sheet is missing, the information can be supplied by your local sales office.



Figure 1-1. Model 3200B VHF Oscillator

NOTES

SECTION II INSTALLATION

2-1. INITIAL INSPECTION.

2-2. **MECHANICAL CHECK.** If damage to the shipping carton is evident, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for scratches, dents, broken knobs and switches, and any other mechanical damage. Also check the cushioning material for signs of severe stress as an indication of rough handling in transit.

2-3. **PERFORMANCE CHECK.** The electrical performance of the 3200B should be verified as soon as possible after receipt. A performance check that is suitable for initial inspection is contained in Section V.

2-4. **CLAIM FOR DAMAGE.** If upon receipt, the 3200B is damaged or fails to meet performance specifications, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately (A list of offices is provided at the back of this manual). Retain the shipping carton and padding material for the carrier's inspection. The sales and service office will arrange for the repair or replacement of the instrument without waiting for the claim against the carrier to be settled.

2-5. PREPARATION FOR USE.

2-6. POWER REQUIREMENTS.

2-7. The 3200B requires a power source of 105 to 125 V or 210 to 250 V, 50 to 1000 Hz, which can supply approximately 30 watts.

2-8. 115/230 VOLT OPERATION.

2-9. A two-position slide switch, located on the rear panel, permits operation from either a 115 or 230 volt power source. Before connecting the 3200B to the power source, check that the number visible on the slide switch matches the nominal line voltage of the source. If required, slide the switch to the other position using a thin-bladed screwdriver.

2-10. When the instrument leaves the factory, the proper fuse is installed for 115-volt operation. An envelope containing a fuse for 230-volt operation is attached to the front handle. Markings on the rear panel adjacent to the fuseholder indicate the correct fuse rating for operation from either power source. Make sure that the correct fuse is installed if the position of the slide switch is changed.

2-11. POWER CABLE.

2-12. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panels and cabinets be grounded. The 3200B is equipped with a detachable, three-conductor power cable which, when plugged into an appropriate receptacle, grounds the panel and cabinet of the instrument. The offset pin on the power cable three-prong connector is the ground pin.

2-13. To preserve the protective feature when operating the instrument from a two-contact outlet, use a three-prong adapter (-hp- Stock No. 1251-0048) and connect the green pigtail on the adapter to ground.

2-14. VENTILATION

2-15. The 3200B utilizes both tubes and semiconductors. Heat is dissipated through conduction and radiation from the large metal pieces which act as heat sinks. This instrument has been tested to operate satisfactorily with ambient temperatures up to 55° C (131° F). Ventilation should be provided to avoid exceeding this temperature.

2-16. INSTALLATION

2-17. This instrument may be rack mounted after installation in a combining case (-hp- 1052A) or a rack adapter frame (-hp- 5060-0797). The area not used by the instrument, in either case, may be covered by a filler panel (-hp- 5060-0794). When rack mounting this instrument, special provision must be made for access to the output connector and attenuator adjustment which are on the rear panel of the instrument.

2-18. REPACKAGING FOR SHIPMENT

2-19. The original shipping carton and packing material should be used for repackaging. A Hewlett-Packard Sales and Service Office will provide information and recommendations on materials to be used if the original packaging materials are not available or reusable. The packaging materials should include the following:

- a double-walled carton
- heavy paper or cardboard to protect all instrument surfaces

- extra material around projecting parts of instrument
- at least four inches of tightly-packed shock-absorbing material surrounding the instrument
- durable shipping tape to securely seal the carton

NOTE

If the instrument is to be shipped to a Hewlett-Packard Sales and Service Office, attach a tag showing owner, model number, complete serial number, and repairs required. Mark the shipping container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

SECTION III OPERATION

3-1. INTRODUCTION.

3-2. The Model 3200B VHF Oscillator provides a convenient source of RF power over the frequency range of 10 to 500 MHz. Power output is in excess of 25 mW or 1.1 V (across 50 ohm load) on all bands. Below 260 MHz, the power output is in excess of 150 mW or 2.7 V (across 50 ohm load). Below 130 MHz the power output is in excess of 200 mW or 3.1 V (across 50 ohm load). The output attenuator will provide greater than 120 dB attenuation from the maximum output at any frequency setting.

3-3. OPERATING CONTROLS

3-4. Figure 3-1 identifies and briefly describes the purpose of each 3200B front and rear panel control, switch, and connector.

3-5. OPERATING INSTRUCTIONS

3-6. GENERAL

3-7. The following paragraphs will describe the turn-on procedure and typical operating instructions of the Model 3200B VHF Oscillator. All numbers after control and connector names in the following paragraphs refer to the callouts in Figure 3-1.

3-8. TURN-ON PROCEDURE

3-9. Turn-on the 3200B according to the following steps:

a. Ensure that the 115/230 V slide switch **11** is set for the nominal line voltage. The switch position can be changed by using a thin-bladed screwdriver.

b. Ensure that the proper power line fuse **12** is installed in the fuseholder. The correct fuse rating is marked on the rear panel.

c. Connect the ac power line to the power line connector **13**.

d. Rotate RF VERNIER control **4** clockwise away from POWER OFF position; pilot light **5** will glow.

NOTE

The maximum RF output will be obtained if the RF VERNIER control is rotated fully clockwise. To obtain specified accuracies, the 3200B should be permitted to warm up the length of time prescribed in the Specifications, Table 1-1.

3-10. USING THE OUTPUT ATTENUATOR

3-11. The output level from the 3200B is controlled by a piston-type attenuator. The attenuator probe is graduated in twelve 10-dB steps with no absolute values shown. The probe may be locked in any position along its length by the slight rotation of the spring-loaded, knurled, locking ring on the attenuator. There is no stop on the attenuator probe, therefore it may be completely withdrawn from the tube; care should be taken to prevent its damage.

3-12. MODULATION INPUTS

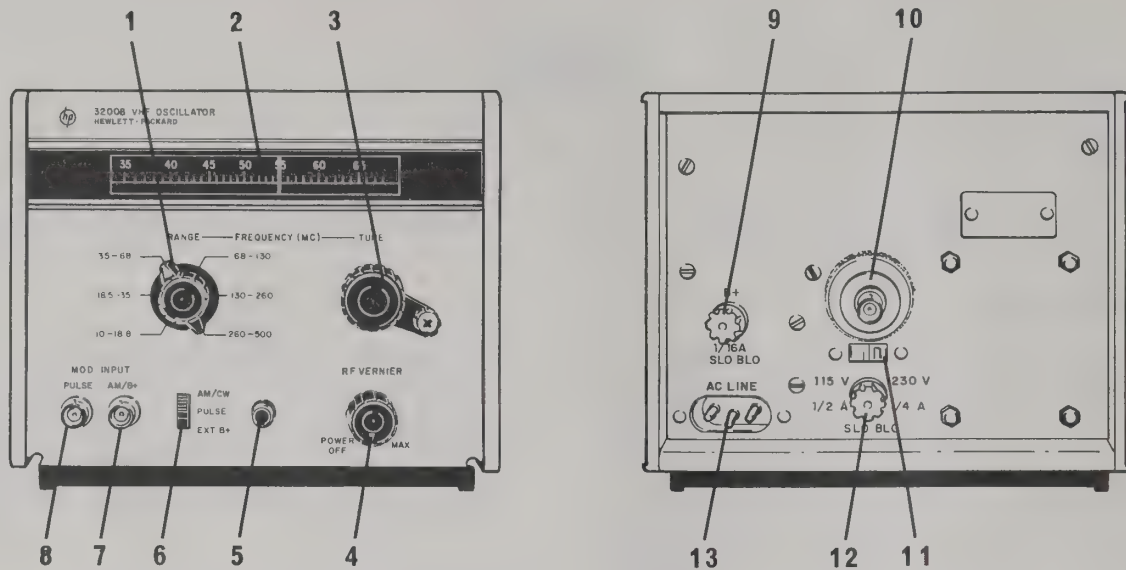
3-13. The 3200B has two modulation input connectors **7** and **8** and a three position AM/CW-PULSE-EXT B+ switch **6**. Modulating frequencies over the range of 200 Hz to 100 kHz can be used with combinations of input connections and switch positions. Sine waves, complex waves, positive-going pulses, and negative-going pulses may be used to modulate the 3200B. Basically, the 3200B is a CW source, so the instructions which follow are only recommended operating modes.

3-14. AMPLITUDE MODULATION. Prepare the 3200B for the amplitude modulation operating mode as follows:

a. Set the modulation switch **6** to AM/CW position.

b. Set RF VERNIER control **4** to minimum position (fully counterclockwise, but not in the POWER OFF position).

c. Connect modulation signal (200 Hz to 100 kHz) to MOD INPUT-AM/B+ connector **7**; a modulation signal of approximately 20 V rms will result in 30% amplitude modulation with less than 1% distortion.



- 1 RANGE Switch - selects RF output frequency range.
- 2 Frequency Dial - indicates selected frequency range and output frequency.
- 3 TUNE Control - selects RF output frequency within range indicated on frequency dial.
- 4 RF VERNIER Control - varies B⁺ supply to oscillator, effecting small changes in RF power output and output frequency; POWER OFF Switch is operated in fully counterclockwise position of the control.
- 5 Pilot Light - lights when POWER OFF switch is turned on.
- 6 AM/CW-PULSE-EXT B⁺ Switch - selects 3200B operating mode.
 - AM/CW Position - permits RF output to be amplitude modulated; CW output is obtained when modulation signal is not applied.
 - PULSE Position - permits RF output to be pulse modulated with 2.5 volt negative-going pulses.
 - EXT B⁺ Position - permits use of external B⁺ supply; RF output is turned off, placing the 3200B in standby condition until external B⁺ is supplied.
- 7 MOD INPUT - AM/B⁺ Connector - permits an external modulation voltage or an external B⁺ supply to be connected to the 3200B.
- 8 MOD INPUT - PULSE Connector - permits an external pulse to be connected to the 3200B.
- 9 Fuse, B⁺ supply - fuse rating is indicated on rear panel.
- 10 Output Attenuator and RF Output Connector - the RF output connector is an integral part of the piston-type attenuator; the attenuator is uncalibrated, but is graduated in 10 dB increments.
- 11 115/230 V Slide Switch - matches instrument to nominal line voltage.
- 12 Fuse, power line - fuse rating is indicated on rear panel.
- 13 Power Line Connector - provides for connection of ac power line.

Figure 3-1. 3200B Operating Controls

NOTE

With the modulation switch in the AM/CW position, no resistance less than 1 K ohm should be connected across the MOD INPUT-PULSE connector. A low resistance will change the -6 V bias to the pulse modulation circuit sufficiently to reduce or stop the RF oscillator output.

3-15. PULSE MODULATION. Prepare the 3200B for the pulse modulation operating mode as follows:

a. Set modulation switch **6** to PULSE position.

b. Connect modulation signal to MOD INPUT-PULSE connector **8**; the modulation signal shall consist of negative-going pulses, not exceeding a peak amplitude of 2.5 V.

NOTE

In this operating mode the RF oscillator is shut off between pulses, thus the on-off ratio for pulse modulation is very high.

3-16. EXTERNAL B+ OPERATION. Prepare the 3200B for external B+ operation as follows:

a. Set modulation switch **6** to EXT B+ position.

b. Connect external B+ to MOD INPUT-AM/B+ connector **7**; the external B+ supply shall have a maximum voltage of 135 volts and a current capacity up to 40 mA.

NOTE

With the modulation switch in the EXT B+ position, no resistance less than 1 K ohm should be connected across the MOD INPUT-PULSE connector. A low resistance will change the -6 V bias to the pulse modulation circuit sufficiently to reduce or stop the RF oscillator output.

3-17. OPERATIONAL GUIDE

3-18. In the practical application of the 3200B, the following information should assist in providing more accurate results as the capabilities and limitations of the instrument are expanded upon.

3-19. OUTPUT LEVEL

3-20. Operating efficiency in a wide-band oscillator varies across the entire band. Thus, the output power also varies. The typical maximum output over the range of the 3200B is shown in Figure 3-2. The maximum output into 50 ohms has been determined by observing the output of the 3200B, while adjusting the probe, without regard to probe calibration markings.

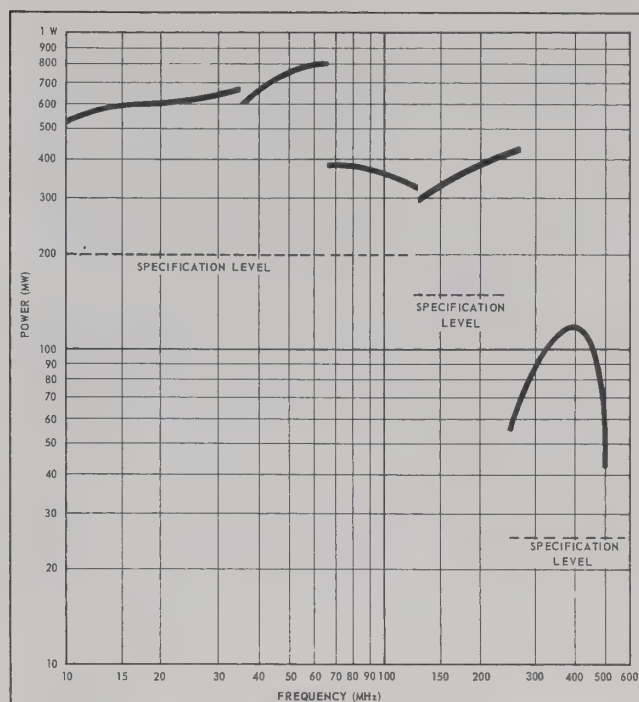


Figure 3-2. Typical Maximum Power Output

3-21. RF DISTORTION

3-22. The basic oscillator used in the 3200B has two tubes operated in push-pull. In the normal balance condition between the tubes, the push-pull operation suppresses the even-harmonic content of the output waveform. The output of the 3200B is

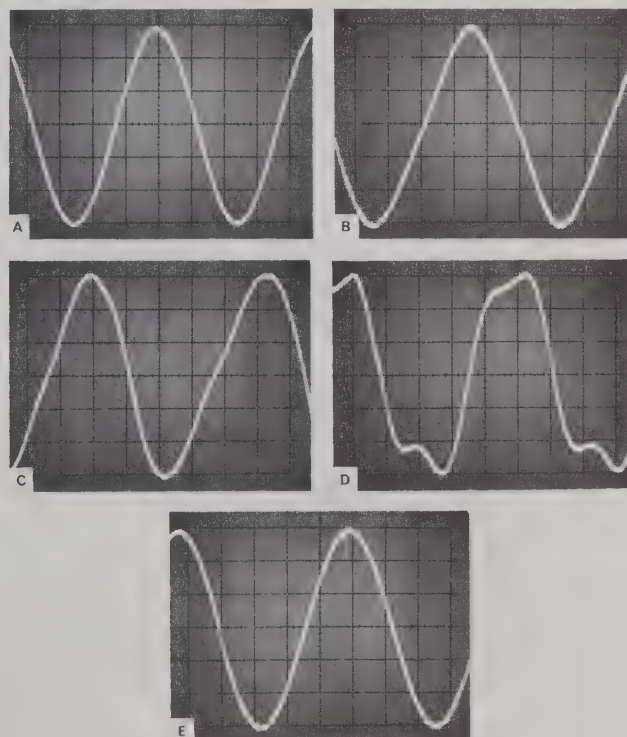


Figure 3-3. Typical RF Output Waveforms

sinusoidal with very low distortion. Using a high frequency sampling oscilloscope (such as the -hp-185B), the RF waveform may be observed directly. The oscilloscope patterns in Figure 3-3 show the typical output of the 3200B at various frequencies. Figure 3-3A is the output waveform at 100 MHz. Figures 3-3B and 3-3C are RF waveforms at 400 MHz and 500 MHz respectively. At the higher frequencies, and at lower output levels, the waveshape departs slightly from sinusoidal as the slope of the curve through the baseline resembles a straight line. With a very low output level at 460 MHz, even harmonics show up in the waveform as in Figure 3-3D. This condition is due to the lack of perfect electrical balance between two tube circuits, which is normal, as lead lengths and tube and component characteristics differ slightly. At the higher output levels, and on the high frequency range, the RF waveshape again resembles the shape shown in Figure 3-3A. By the use of a low-pass filter, the output waveshape may be restored to its original shape, as in Figure 3-3E.

3-23. TYPICAL DRIFT

3-24. The output level of the 3200B is quite stable for long periods of time. However, the frequency will drift slightly. Also, after complete warmup, the frequency stability will change as a result of switching ranges or readjusting the frequency dial. Typical frequency drift (for 5 minutes after a 4-hour warmup), on the various ranges, is shown in Figure 3-4. The drift is shown as a percentage of the initial frequency setting.

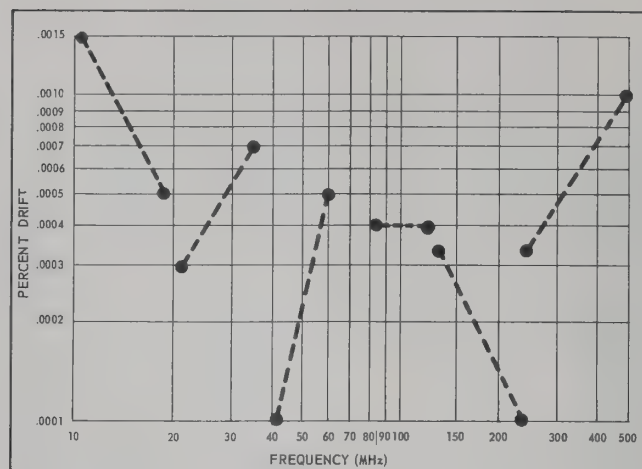


Figure 3-4. Typical Frequency Drift

3-25. FREQUENCY RESPONSE (MODULATION)

3-26. The 3200B is amplitude modulated by capacitively coupling a modulating signal to the Oscillator tube plate voltage supply. The modulated dc is fed via a low-pass filter, into the RF housing. This filter must have a relatively low audio cut-off frequency to prevent RF leakage at the lowest RF frequency of 10 MHz. However, the response is essentially flat across the audio range from 200 Hz to 100 kHz. Figure 3-5 shows the typical frequency response with RF frequencies of 10 MHz and 100 MHz.

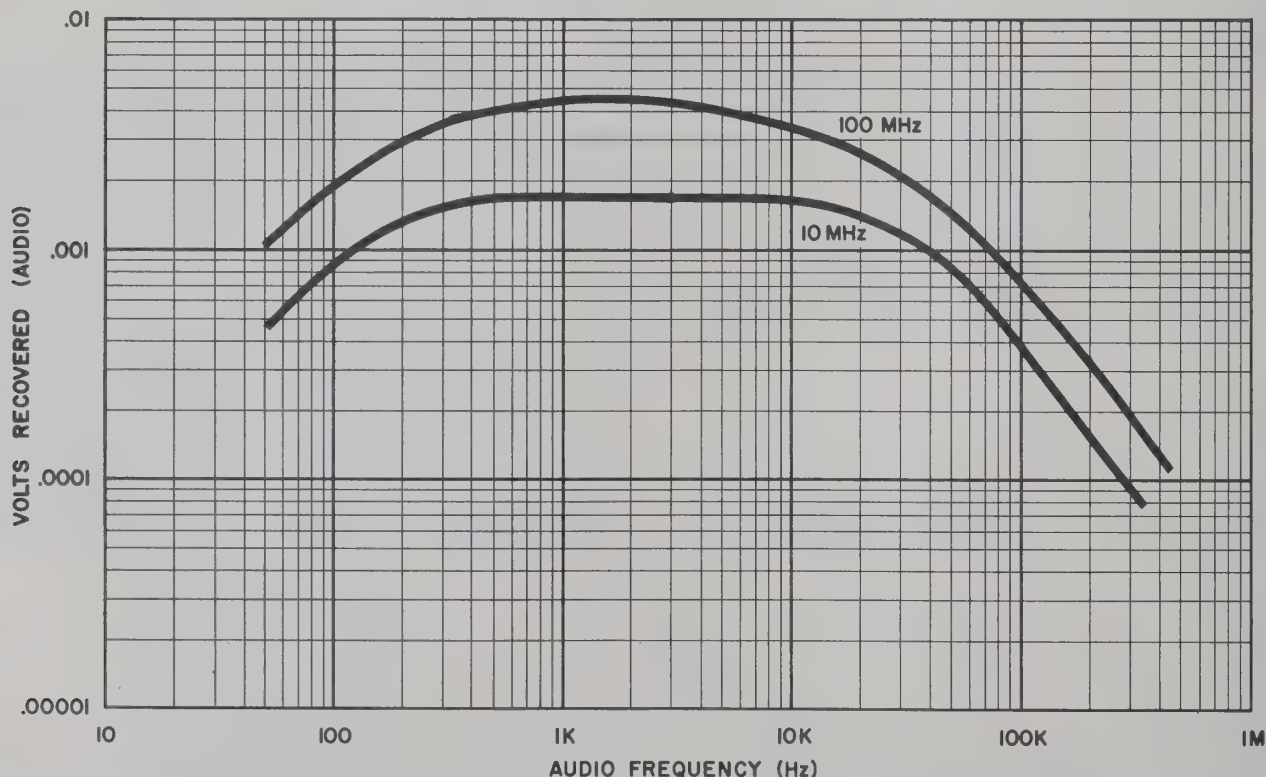


Figure 3-5. Typical Frequency Response

3-27. AMPLITUDE MODULATION

3-28. The 3200B can be used at higher than 30% AM. The 30% AM at less than 1% distortion (See Specifications, Section I) is a limitation because of lack of external control of the internal power supply. The design of the 3200B is such as to allow operation with an external variable dc supply. Depending on the source used, the audio signal may be transformer or capacitively coupled to the dc supply. This composite ac and dc signal is connected to the AM/B+ connector with the modulation input switch in the EXT. B+ position. The only limitation

of this method of modulation is that the dc supply voltage plus the rms voltage of the modulation signal must not exceed 135 volts. (This is the tube manufacturer's design maximum.) One hundred percent modulation is possible with this mode of operation. Recovered audio distortion for 90% amplitude modulation with 1 V rms RF output has been found to be typically less than 3% at 10, 20, 40, 80, 150, 250, 400, and 500 MHz.

3-29. It should be noted that the RF output may not meet the specified levels with this system.

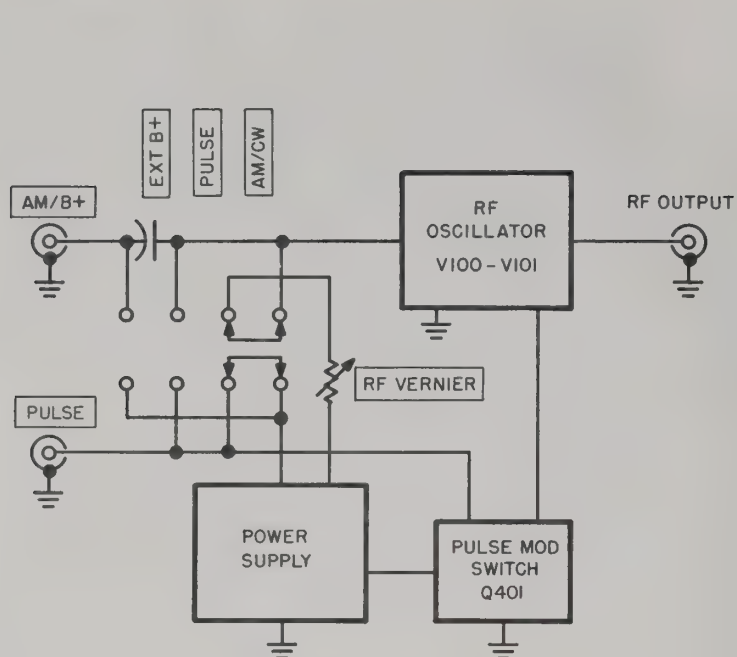


Figure 4-1. Block Diagram 3200B

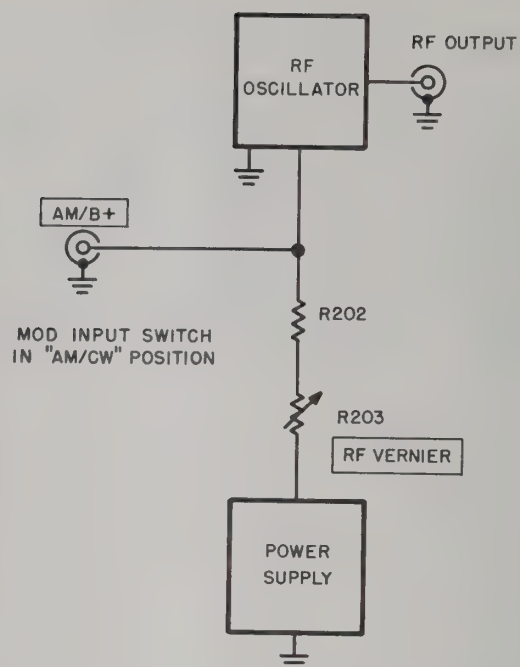


Figure 4-3. Amplitude Modulation 3200B

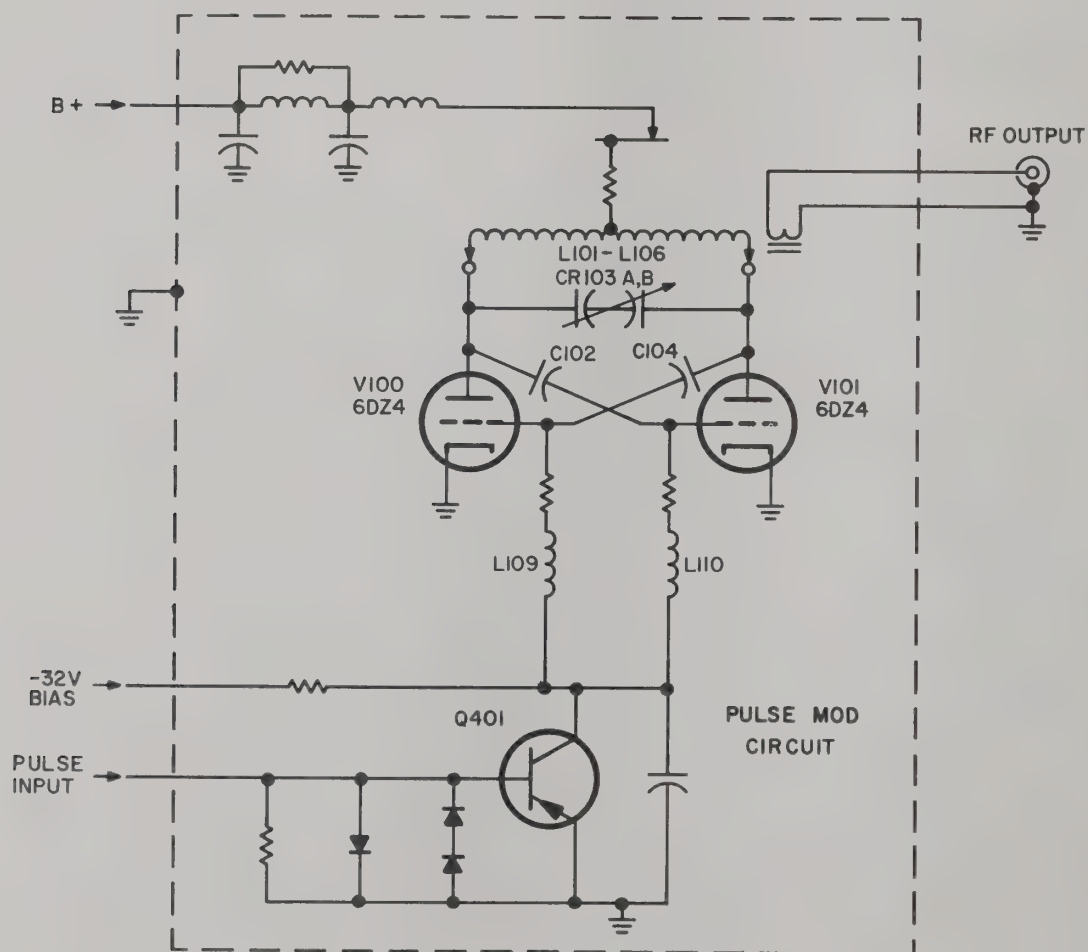


Figure 4-2. RF Oscillator Circuits

SECTION IV PRINCIPLES OF OPERATION

4-1. GENERAL

4-2. The 3200B VHF Oscillator, shown in the block diagram (Figure 4-1), covers the frequency range from 10 to 500 MHz with six overlapping bands. This instrument was designed primarily as a high output source of CW. Circuitry has been incorporated to allow both amplitude and pulse modulation. A variable, piston-type, waveguide-below cutoff attenuator is used to control the output.

4-3. RF OSCILLATOR

4-4. The oscillator circuit, shown in Figure 4-2, generates all of the radio frequencies in the 10 to 500 MHz range of the instrument. The circuit employs two 6DZ4 triodes with push-pull connected plates and grounded cathodes. Simple, fixed feedback is accomplished by means of capacitive dividers consisting of C102 and C104, together with the grid-to-cathode capacitance of the triodes. Chokes L109 and L110, along with good cathode grounding and short grid connections, serve to maintain high grid circuit impedance, preventing phase shift in the feedback voltage divider and consequential oscillation in the circuit at parasitic frequencies.

4-5. Tuning of the oscillator is accomplished by means of a tank circuit which includes coils L101 to L106 and capacitors C103A and C103B. There are six different tank coils; one for each frequency range. The coils are wrapped on a specially formed turret which is detented into one of six frequency range positions by the RANGE switch on the front panel. Wiping contacts are used to connect the selected coil into the tank circuit. The center of each tank coil is neutral and is used as a feed point for plate power, which is connected through a switch operated by the turret drive and a common supply ring on the turret. One hundred ohm resistors (R101 to R106) are connected between the coils and the B+ feed point to break up undesirable RF paths, without introducing appreciable plate voltage or RF loss.

4-6. ATTENUATOR

4-7. The output from the oscillator is coupled to a pickup loop (L107) mounted at the end of a piston in the waveguide-below-cutoff attenuator. The distance between the pickup coil and the output coils on the turret is a fixed amount with the probe fully inserted. With this dimension fixed on each fre-

quency range, the coupling is different. On the high range, with the attenuator probe at maximum penetration, the pickup coil becomes overcoupled to the output coil. In some instances, this over-coupling loads the tuned output circuit to an extent which causes the oscillator to stop. Overcoupling will also cause frequency "pulling" creating dial errors. With this type of attenuator setup, the maximum penetration does not mean maximum output.

4-8. MODULATION

4-9. Amplitude modulation of the 3200B is accomplished by capacitance coupling a modulating signal to the oscillator plate supply. This is shown in block diagram form (Figure 4-3). With this type of modulation, up to 30% AM is possible with less than 1% distortion at input frequencies from 200 Hz to 100 kHz.

4-10. Pulse modulation of the 3200B is explained by the circuitry of Figure 4-4. With no signal input, a -32 volt bias is applied to the oscillator tube grids through R401, junction A, L109, L110, R107, and R108. This bias will stop tube conduction, thereby stopping oscillation. Thus, with no input signal, there will be no output from the 3200B.

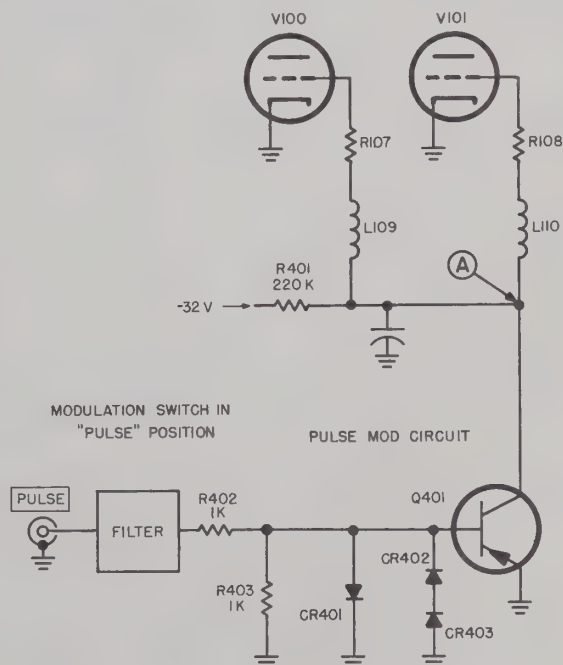


Figure 4-4. Pulse Modulation 3200B

4-11. A 2.5 volt negative-going pulse applied to the base of transistor Q401 will cause the transistor to conduct as the pulse approaches the negative peak. The impedance between the emitter and collector will decrease sufficiently to dissipate the -32 volt bias across R401. This puts junction A at a very low impedance with respect to ground, allowing the tubes to oscillate. As the pulse starts in the positive direction returning to zero potential, the transistor stops conduction, restoring the -32 volt bias to the oscillator tube grids which stops the oscillator. Essentially, the transistor becomes a fast action switch controlling the -32 volt bias to the oscillator grids.

4-12. The circuitry to the base of the transistor has resistors to limit the input impedance of the PULSE input connector and diodes to limit voltage, which could cause damage to the transistor.

4-13. Positive-going pulses to the pulse input connector, with Mod Input Switch in "PULSE" position, will result in no output from the instrument.

4-14. EXTERNAL B+ OPERATION

4-15. In the external B+ mode of operation, the internal plate voltage supply is disconnected. The plate supply lead is connected to the AM/B+ connector. A controlled external power supply connected to the AM/B+ connector will produce CW operation of the instrument. During external B+ operation a -6 volt bias is connected internally to the grid switch transistor, Q401, to keep it in the "ON" condition removing the -32 V bias from the oscillator grids. This circuitry is shown in the block diagram (Figure 4-5).

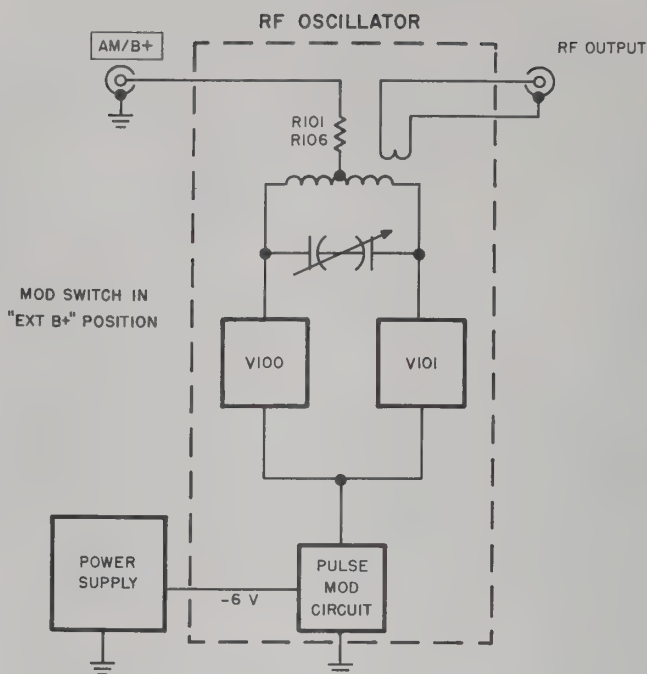


Figure 4-5. External B+ Operation

4-16. The Power Supply consists of two regulated supplies having a common power transformer. The outputs are 150 vdc, 40 mA for the oscillator tube plate supply, and 6.6 vdc, 450 mA for the oscillator tube heater supply. The regulated supplies are also a source of bias for operating the pulse modulation circuit (Z400). A -6 V bias is provided to operate the pulse modulation circuit, and -32 V is provided to turn off the oscillator. A block diagram of the complete supply is shown in Figure 4-6.

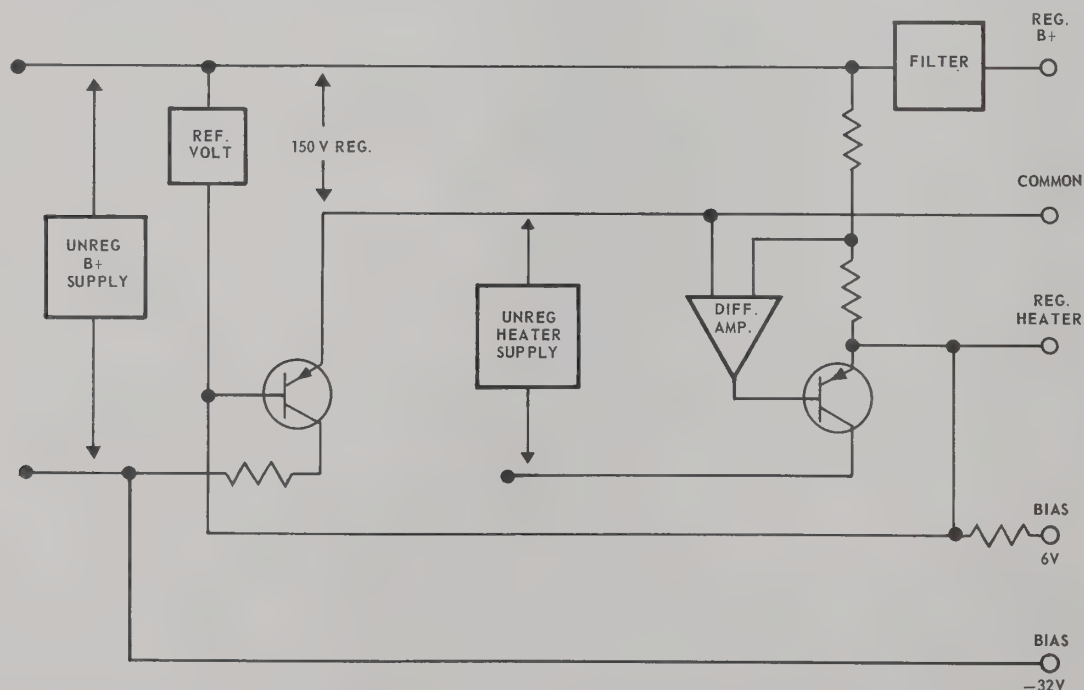


Figure 4-6. Power Supply 3200B

SECTION V MAINTENANCE

5-1. INTRODUCTION.

5-2. The 3200B VHF Oscillator is a very compact instrument, which generally makes equipment difficult to maintain. However, by use of the disassembly procedure for troubleshooting and repair, as described under Mechanical Disassembly Procedures, this instrument can be readily serviced or maintained.

5-3. LUBRICATION

5-4. The 3200B is adequately lubricated for the life of the instrument. Added lubrication is necessary only when lubricants are wiped off during replacement of parts. The instrument should be checked periodically. If the lubrication on the drum dial shaft or the frequency shaft becomes thick, a small amount of light oil should be added to thin the "Molykote" on the shafts. The detent roller should be inspected for lubrication at the bearing. "Molykote G" (-hp- Stock No. 6040-0024) or equivalent should be used on this bearing.

5-5. TEST EQUIPMENT REQUIRED

5-6. The test instruments required to perform the operations of Section V are listed in Table 5-1. They are listed by type and specification. A recommended instrument is also given, however, other instruments may be used provided their performance equals or exceeds the critical specifications.

5-7. PERFORMANCE CHECKS

5-8. The procedures of paragraphs 5-9 through 5-18 check the 3200B VHF Oscillator for incoming inspection, periodic evaluation, calibration, and troubleshooting. The tests can be performed without instrument cover removal. The specifications of Table 1-1 are the performance standards.

5-9. RF RANGE AND ACCURACY

5-10. Connect the Electronic Counter/Converter (with a 10-dB attenuator) to the RF output of the 3200B, withdraw the attenuator probe to the first mark (approximately 1/2 inch), set the RF VERNIER to its maximum position, and allow a minimum of 1/2 hour warmup. On each frequency band, check the frequencies listed in Table 5-2, setting the pointer on each nominal frequency shown. The

frequencies, as read on the Electronic Counter, must fall within the limits shown in Table 5-2. This instrument must be capable of producing all of the nominal frequencies shown with no more than 2% off-scale movement of the pointer.

5-11. RF STABILITY

CAUTION

The -hp- 5253B Frequency Converter and the -hp- 431B Power Meter may be damaged by overload. Extreme care must be used when operating these instruments with the 3200B, which has a high power RF output.

5-12. Adjust the frequency of the 3200B to 100 MHz and allow the instrument to warmup for 4 hours (line voltage set to 115 V). Set RF VERNIER in MAX position and proceed as follows:

a. With attenuator probe withdrawn to the last calibration mark, attach the Power Meter to the RF output connector.

b. Slowly insert attenuator probe until the Power Meter reads 0.2 mW (-7 dBm). (This is an arbitrary value and need not be exact.)

c. Disconnect Power Meter and connect the Frequency Counter/Converter to the RF output connector.

d. Readjust the 3200B Frequency Control until the counter reads approximately 100 MHz.

e. Note counter reading and allow instrument to operate for 5 minutes. The reading should be within 0.002% of original frequency reading. At 100 MHz this is ± 2 kHz.

f. The reading after 1 hour should be within 0.02% of original frequency reading. At 100 MHz this is ± 20 kHz.

g. Readjust the line voltage from 115 V to 120 V. Note counter reading. The frequency must not change by more than 0.001% of reading in step f. At 100 MHz this is ± 1 kHz.

TABLE 5-1. TEST EQUIPMENT RECOMMENDED

Instrument Type	Critical Specifications	Recommended Instrument
Electronic Counter	Frequency Range: 0 - 500 MHz	-hp- 5245L with -hp- 5253B Plug-in
Power Meter	Frequency Range: 10 - 500 MHz Power Range: +10 dBm to -15 dBm or 10 dBw to -30 dBw (-hp- 434A)	-hp- 431B with -hp- 478A Thermistor Mount or -hp- 434A
10-dB Attenuator	To extend power range of the -hp- 431B and to protect the electronic counter input from high power	-hp- 8491A
20-dB Attenuator		-hp- 8491A
VHF Oscillator	RF Range: Same as 3200B Output: Same as 3200B	-hp- 3200A/B
Oscilloscope	Frequency Range: 450 kHz Sensitivity: 1 mV/cm	-hp- 130C
High Output Audio Oscillator	Output: 3 W (42.5 V) across 600 ohms	-hp- 201C or -hp- 205AG
Diode Mixer	Frequency Range: Same as 3200B	-hp- 10514A
Electronic Voltmeter	AC-DC Voltage Range: to 300 V, Accuracy: $\pm 2\%$	-hp- 410C
Distortion Analyzer	Frequency Range: 200 Hz to 100 kHz Distortion Range: Less than 1%	-hp- 331A
50-ohm Termination	Capable of handling 1/2 W	-hp- 908A
Power Supply	0 to 7.5 V	-hp- 6203A
Probe Coax T Connector	For use with the -hp- 410C Electronic Voltmeter	-hp- 11042A

TABLE 5-2. RF ACCURACY LIMITS

Nominal Frequency (MHz)	Upper Frequency Limit (MHz)	Lower Frequency Limit (MHz)
10	10.2	9.8
18.5	19.176	18.424
18.5	18.87	18.13
35	35.7	34.3
68	69.36	66.64
130	132.6	127.4
260	265.2	254.8
500	510	490

5-13. RF OUTPUT

5-14. To measure RF power output proceed as follows:

a. Connect a 20-dB attenuator and power meter to the RF output connector with the 3200B attenuator near minimum output.

b. Set the 3200B RANGE switch to the 10 - 18.8 MHz range.

c. Insert 3200B attenuator probe until power meter reads 2 mW. Check RF output across the band, readjusting 3200B attenuator probe if power meter reading drops below 2 mW. Because coupling is not directly related to insertion distance maximum power may result with less than maximum insertion. In addition, overcoupling the probe may load the oscillator enough to shift its frequency.

d. Repeat step c on 18.5 - 35 MHz, 35 - 68 MHz, and 68 - 130 MHz ranges.

e. Set the 3200B RANGE switch to the 130 - 260 MHz range.

f. Insert 3200B attenuator probe until power meter reads 1.5 mW. Check RF output across the band, readjusting the 3200B attenuator probe if power meter reading drops below 1.5 mW.

g. Set the 3200B attenuator for minimum output with RANGE switch in 260 - 500 MHz range.

h. Remove the 20-dB attenuator and replace it with the 10-dB attenuator.

- i. Insert 3200B attenuator probe until power meter reads 2.5 mW.

CAUTION

When setting the attenuator, the probe must not be completely inserted in the tube while the instrument is operated at the low frequency end of the 260 to 500 MHz range. The loading on the oscillator by the attenuator could cause the oscillator to stop. In this condition, the tubes will draw excessive current causing the B+ supply fuse to open.

- j. Check the output across the band, readjusting the 3200B attenuator probe if the output drops below 2.5 mW.

5-15. AM RANGE AND DISTORTION

5-16. Connect the equipment as shown in Figure 5-1, set the 3200B under test to any convenient frequency, and proceed as follows:

- a. With input to MOD INPUT-AM/B+ on 3200B temporarily disconnected, adjust the second VHF Oscillator for zero beat as observed on oscilloscope. (Use oscilloscope internal sweep for this setup.)

- b. Adjust the second VHF Oscillator away from zero beat until a clean rectangle is observed (Figure 5-2A).

- c. Connect the audio oscillator to the MOD INPUT-AM/B+ terminal on the 3200B under test. Set the audio frequency between 200 Hz and 20 kHz.

- d. Adjust the audio oscillator output to form a trapezoid which has a long vertical side of 10 oscilloscope divisions and a short vertical side of 5.39 oscilloscope divisions (Figure 5-2B). (The oscilloscope pattern width is not important but must be kept within screen limits for observing sides of pattern.) At this point, the RF output is amplitude modulated 30%.

- e. Connect the AC VTVM across the MOD INPUT-AM/B+ connector. The meter reading shall be $20 \text{ V} \pm 7 \text{ V}$.

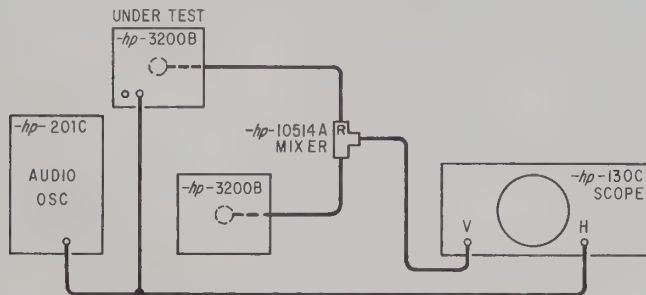


Figure 5-1. AM Characteristics Setup

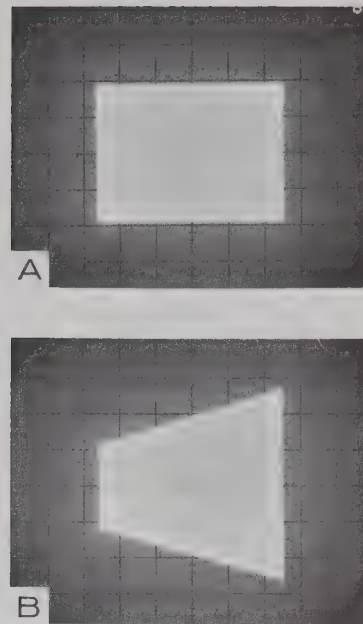


Figure 5-2. AM Characteristics Oscilloscope Displays

- f. Disconnect the 3200B used as a beat frequency oscillator and add the 50-ohm termination in its place at diode mixer. Replace the oscilloscope with the distortion analyzer.

- g. Measure the distortion of the recovered audio.

- h. Without changing the audio oscillator setting, measure the audio oscillator distortion directly. The difference in distortion between the recovered audio frequency and the output of the audio oscillator should be less than 1%.

5-17. EXTERNAL PM REQUIREMENTS

5-18. Connect the equipment as shown in Figure 5-3, and proceed as follows:

- a. Disconnect the power supply temporarily and set the 3200B for AM/CW operation with an output frequency of 100 MHz. (This frequency is not critical and may be changed to suit equipment available for this test.)

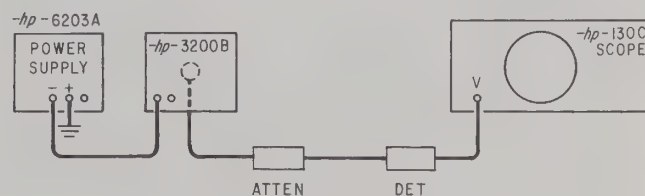


Figure 5-3. PM Requirements Setup

b. Adjust the 3200B attenuator probe for maximum output as indicated on the oscilloscope. (Using a diode detector with CW, the output appears as a straight line at some dc level on the oscilloscope.)

c. Connect the power supply to the MOD INPUT-PULSE connector. Change the modulation input switch to the PULSE position.

d. Increase the power supply output until the level indicated on the oscilloscope is the same as in step b.

e. Measure the dc voltage level of the power supply. The dc voltage should be -2.5 volts or less.

5-19. TROUBLESHOOTING AND REPAIR

WARNING

Removing the top cover of the instrument exposes the power transformer secondary winding connections on the printed circuit board which constitutes a shock hazard if the instrument is operated in this condition.

5-20. TROUBLESHOOTING CHART

5-21. The Troubleshooting Chart, Figure 5-4, is in the form of a troubleshooting tree. The tree shows a logical sequence to be used for determining a

fault when the power output from the 3200B is too low or when there is no output. Follow each step toward the normal (T-true) or abnormal (F-false) condition as determined by indicated tests.

5-22. TUBE AND SEMICONDUCTOR REPLACEMENT

5-23. All tubes and semiconductors are easily accessible after the 3200B is disassembled for troubleshooting and repair as described under Paragraph 5-32.

5-24. TRANSISTOR INSULATORS

5-25. Some of the transistors in this instrument are insulated electrically from the heat sink. For maximum transfer of heat to the heat sink through the insulator, it is coated on both sides before assembly with silicone grease (-hp- Stock No. 8500-0059). If these transistors are replaced, the replacement should also be coated with the grease.

5-26. VOLTAGES

5-27. Voltages shown in the schematic, Figure 5-12, indicate the normal operating conditions for the 3200B while in the troubleshooting condition. (RF shield removed and no load on the output.) Voltages were measured with a -hp- 410B VTVM. They indicate typical operation and do not constitute specifications.

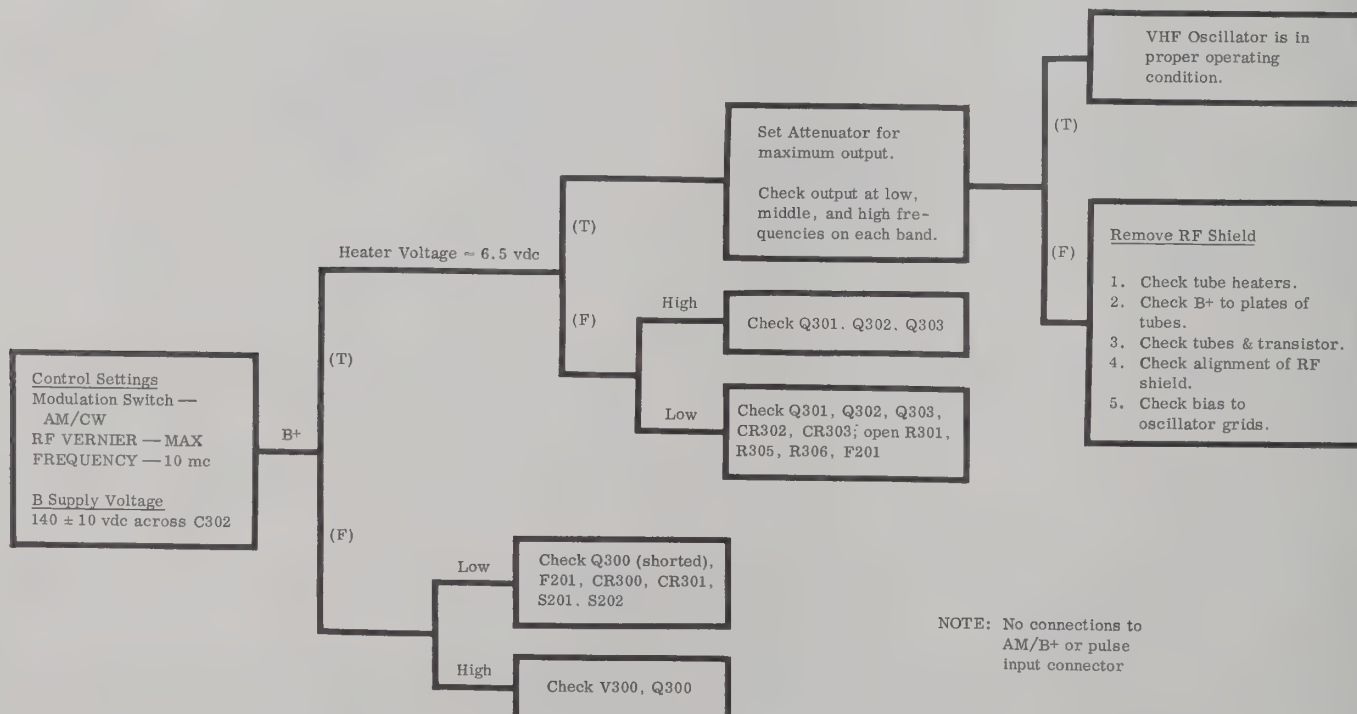


Figure 5-4. Troubleshooting Tree - Power Output

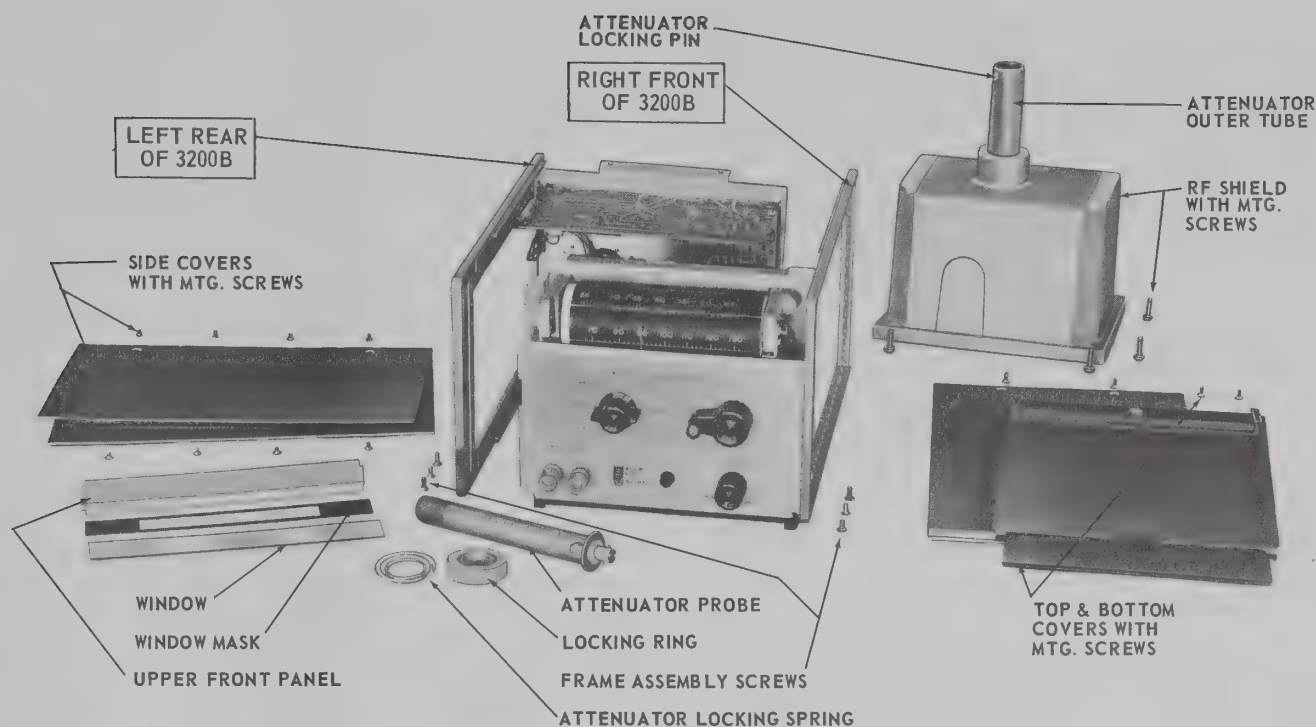


Figure 5-5. Troubleshooting and Repair Setup

5-28. MECHANICAL DISASSEMBLY PROCEDURES

5-29. COVER REMOVAL

5-30. TOP AND BOTTOM COVERS. Remove two screws at the rear of the instrument. Slide cover toward the rear of the instrument to disengage lip at front panel.

5-31. SIDE COVERS. Remove four screws from each side cover. Top and bottom covers need not be removed to remove side covers.

5-32. TROUBLESHOOTING AND REPAIR SETUP

5-33. Refer to Figure 5-5 and proceed as follows:

- a. Remove top, bottom, and side covers.
- b. At rear of instrument, remove attenuator probe. Rotate attenuator retaining ring one complete turn. Slide retaining ring and locking spring off of attenuator tube. Locking pin will remain in tube. During reassembly of retaining ring, the pin must be pressed back in place.
- c. Remove plug P200 from receptacle J200.
- d. At right side of the instrument, remove the two screws retaining the rear panel and one screw retaining the printed circuit board.
- e. At left side of the instrument, remove the one screw retaining the front panel switch plate and the two screws retaining the RF base plate assembly.

f. Carefully separate the instrument into two pieces. The left side and rear panel constitute one piece. The right side and lower front panel constitute the second piece.

NOTE

Care should be taken as the upper front panel, front panel window, and window mask will be loose parts and should be removed during troubleshooting and repair procedures.

g. Remove four screws retaining the RF shield casting and slide it carefully away from the RF base plate assembly.

h. Replace P200 plug in J200 receptacle.

5-34. The 3200B is now in operating condition. The attenuator probe may be placed in approximately normal position by reversing the RF shield casting.

5-35. FRONT PANEL DISASSEMBLY

5-36. Remove top, bottom, and side covers, and proceed as follows:

- a. At left side of the instrument, remove the one screw retaining the front panel switch plate, two screws retaining the RF base plate assembly. At right side, remove one screw retaining the printed circuit board.
- b. At left side of the instrument, loosen the two screws retaining the rear panel.

c. At right side of the instrument, remove one screw retaining the front panel switch plate.

d. Using a 5/64 inch Allen wrench, remove the two front panel control knobs.

e. Carefully separate the left side frame from the front panel.

NOTE

Care should be taken as the upper front panel, front panel window, and window mask will be loose parts and should be removed during this procedure.

f. Carefully separate the right side frame from the front panel. The front panel will be restrained only by the wires attached.

5-37. TURRET ASSEMBLY REMOVAL

5-38. The turret assembly may be readily removed with the 3200B in the troubleshooting and repair condition. However, the turret position on the shaft is very critical and the RF frequency alignment should be checked after replacement. (See RF Calibration, Paragraph 5-44 before removing turret).

5-39. DIAL STRINGING PROCEDURE

5-40. The dial stringing should be done with the front panel disassembled, but not disconnected from the instrument. Refer to Figure 5-6 and proceed as follows:

a. Using approximately 4 feet of 0.027 inch diameter, nylon covered, glass core dial cord, thread about 15 inches of cord through the right side hole in the cursor.

b. Loop the cord once around pin on cursor and thread balance of cord through left side hole in the cursor.

c. Thread the 15-inch section of cord around the small right side pulley, through the RF base plate, and around the large pulley to the "start" pin on the large pulley.

d. At this point, the notch in the large pulley should face the rear of the instrument ($\pm 45^\circ$), and the dial pointer should be near the 10 MHz calibration mark. Secure the dial cord on the pin.

e. Thread the dial cord around the small left side pulley, the angle pulley, etc. as shown in Figure 5-6.

f. Before securing the cord on the dial spring, adjust tension so as to extend spring no more than 1/8 inch.

g. The frequency control should be rotated to the extremes of the dial travel to assure proper operation.

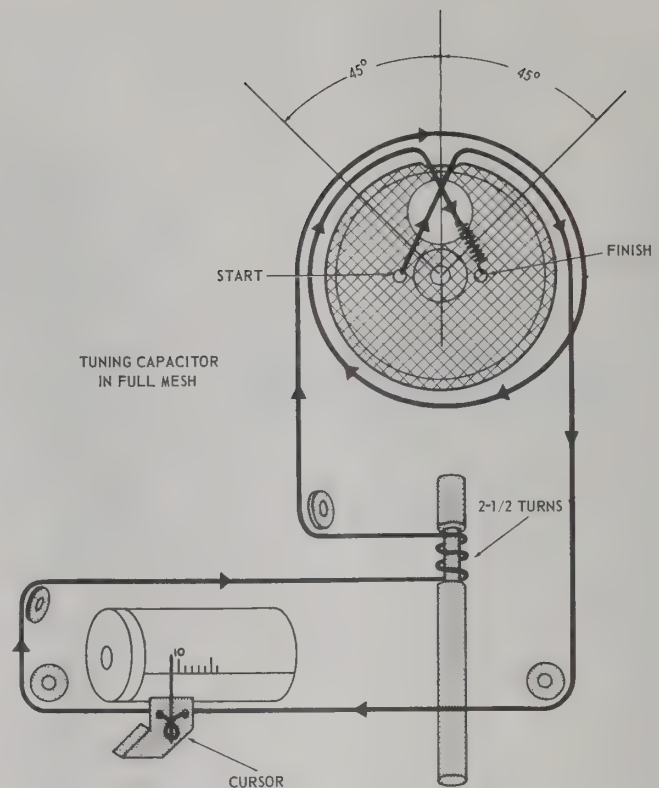


Figure 5-6. Dial Stringing

h. With the tuning capacitor fully meshed, the dial pointer should be 1/32 to 1/16 inch to the left of the 10 MHz calibration mark. Required adjustment can be made by slipping the pulley on the tuning capacitor shaft.

5-41. ADJUSTMENT AND CALIBRATION

5-42. Any tolerances listed in this section are the limits indicated by the Specifications in Table 1-1. Factory adjustments are made to considerably closer tolerances. Field adjustments to closer than specified tolerances are possible if time and patience are used.

5-43. POWER SUPPLY.

a. Connect the 3200B to a power source set to 115 V. Connect the VTVM (dc function) from junction CR305 - R303 (-) on printed circuit board and chassis ground (+).

b. Heater voltage should be -6.6 ± 0.13 vdc. Readjust R306 (Htr Adj) if required. (-6.6 V at power supply is equivalent to -6.0 V at tube socket terminals.)

c. Change input voltage to 125 V and then 105 V. Heater voltage must be within $\pm 2\%$ of voltage in step b.

d. Disconnect the VTVM and connect the oscilloscope in its place.

e. The ac signal on the heater line must be less than 50 mV P-P.

f. Change the oscilloscope connections to points across capacitor C302.

g. The ac signal on the B+ supply line must be less than 20 mV P-P.

h. Disconnect the oscilloscope and connect the VTVM between chassis ground and pin #1 or #5 of V300.

i. The B+ supply voltage should be 150 V \pm 10 V.

5-44. RF CALIBRATION INCLUDING TURRET RE-ASSEMBLY PROCEDURES. After the original factory calibration, the only reason for recalibration would be as a result of replacing the turret, a critical component mounted on the tube shelf, or the complete tube shelf assembly. Before attempting turret disassembly or frequency calibration, the following information should be noted:

a. The original turret may be removed and replaced without complete calibration, if it is replaced as precisely as possible in its original position on the shaft. A scribe mark on the shaft can be used as a guide for position along the shaft. The turret contacts should be centered on the capacitor contacts.

b. The position of the turret along the shaft is restricted by the ability of the turret to operate Switch S101 on the two lower frequency ranges; also, the ability of the turret tuned circuit on the 260 to 500 MHz range to allow the instrument to tune the range required.

c. The normal mechanical tolerances of the holes used for mounting the RF shield casting is such as to affect the calibration. Shifting the casting slightly will change frequency and output power slightly so the correct position should be checked electrically.

d. The attenuator probe must be properly oriented with respect to the turret. Changing the turret could result in mechanical interference.

e. There is circuitry in the 3200B used to suppress parasitics. C108 is the only adjustable component which serves this purpose. For adjustment of C108, see Paragraph 5-46. The other circuitry is not adjustable but is controlled by component position and lead length. If replacement is required, these parts should be replaced as close as possible to their original position. The suppressor circuits consist of:

- (1) C117 and R110
- (2) C119, R111, and R112
- (3) C120, C108, R109, and L108
- (4) C121, R113, and R119

f. The calibration of this instrument can be performed with the RF shield removed and the attenuator probe supported in a position approximately 1/2 inch from the turret simulating its normal position. Replacing the RF shield will increase the frequency by nominally 1%. For increased accuracy, the instrument should be checked with the shield in place. To touch-up the core adjustment of any or all of the four lower frequency ranges the threaded plug may be removed to gain access to the core. The access hole is located so as to require 180° rotation of the RANGE switch to place the required turret coil in position for adjustment. A trial and error procedure will have to be followed. To decrease inductance, rotate core in clockwise direction.

g. If the overall calibration of the 3200B is off by approximately the same amount and in the same direction (either too high or too low) the pulley on the tuning capacitor may be slipped on the shaft to compensate for the error.

h. Changing tubes or normal aging of components in the 3200B should not require complete recalibration of the instrument. Typically the change in frequency is within the normal tolerance specified for the 3200B.

5-45. TURRET REASSEMBLY.

a. Set RANGE switch to the 10-18.8 MHz range.

b. Slide the turret on the shaft so that the turret contacts do not touch the capacitor contacts when the turret is moved along the shaft.

c. Rotate the turret until the turret contacts are centered on the capacitor contacts, and tighten set screws enough to hold turret in place.

d. On the lower two ranges, Switch S101 must be operated by the cam on the turret.

e. Change RANGE switch to the 260-500 MHz range and check end frequencies (260 and 500 MHz) using a frequency counter.

- (1) If an original turret is being reassembled, the range should be correct but the dial settings may be off (either too high or too low). In this case, the turret may be moved closer to the front of the instrument to increase the output frequencies, or toward the rear to decrease the frequencies. Only a few thousandths of an inch movement will be required.
- (2) If a new turret is being assembled on the shaft, the new turret should be set as closely as possible to the original turret position and the calibration procedure used for adjustment.

f. Check the other five ranges to assure proper calibration. (See Calibration Procedure, Paragraph 5-46 for adjustment, if required.)

5-46. CALIBRATION.

NOTE

See Troubleshooting and Repair Setup, Paragraph 5-32.

a. The RF shield cover should be reversed so it may be used to hold the attenuator probe in a somewhat normal position about 1/2 inch from the turret.

b. Connect the equipment as shown in Figure 5-7.

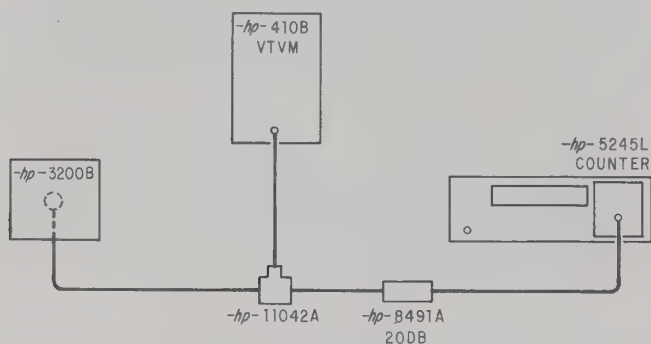


Figure 5-7. RF Calibration Setup

c. Set the RANGE switch to the 260-500 MHz range. Check the frequency at 260 and 500 MHz. The counter should read within $\pm 2\%$ of dial setting. If not, adjust the inductance of the inductor for this range by adding or removing solder from the slots in the inductor. For a small change in the inductance, the turret may be moved along the shaft.

- (1) Move the turret away from the RF tube shelf to increase the inductance in the capacitor contacts. This effectively reduces stray capacitance between the turret and the tube shelf.
- (2) Move the turret toward the RF tube shelf to decrease the inductance in the capaci-

tor contacts. This increases the stray capacitance between the turret and the tube shelf.

d. At 260 MHz, adjust the attenuator probe for maximum output. This should be 25 mW (approximately 1.1 V on the VTVM, assuming ideal conditions). Adjust C108 for maximum output as read on the VTVM.

e. Set RANGE switch to the 130-260 MHz range. Check 130 and 260 MHz frequencies. The counter should read within $\pm 2\%$ of dial settings. If not, adjust inductance by bending coils to increase or decrease inductance.

f. The four lower frequency ranges should be checked and inductances adjusted by means of the ferrite core in each inductor.

NOTE

If any of these coils required adjustment, the coils should be recoated with Communications Products Co. "Q-max A-27".

g. Replace the RF shield cover and the attenuator. The four mounting screws should be adjusted so as to exert equal pressure at each screw.

h. Check power output on all ranges. The power output must be greater than:

- (1) 200 mW (3.2 V across external 50 ohms) on the 10-18.8 MHz, 18.5-35 MHz, and 68-130 MHz ranges.
- (2) 150 mW (2.7 V across external 50 ohms) on the 130-260 MHz range.
- (3) 25 mW (1.1 V across external 50 ohms) on the 260-500 MHz range.

5-47. For more accurate measurement of the output power, the -hp-431B Power Meter (or equivalent) with an -hp-478A Thermistor Mount is recommended in addition to a low VSWR 20-dB attenuator.

SECTION VI REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designations and indicates the description and -hp- Stock Number of each part. An Illustrated Parts Identification follows Table 6-2 giving mechanical breakdown of the 3200B. Adjacent tables, keyed to Figures 6-1 to 6-5, indicates the -hp- Stock Number and description.

6-3. ORDERING INFORMATION

6-4. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Sales and Service Office (see lists at rear of this manual). Identify parts by Hewlett-Packard Stock Number.

6-5. To obtain a part not listed, include:

- a. Instrument model and serial number
- b. Description of part
- c. Function and location of parts

REFERENCE DESIGNATORS

A	= assembly	E	= misc electronic part	P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor	F	= fuse	Q	= transistor	W	= cable
BT	= battery	FL	= filter	R	= resistor	X	= socket
C	= capacitor	J	= jack	RT	= thermistor	Y	= crystal
CP	= connecting part	K	= relay	S	= switch	Z	= network
CR	= diode	L	= inductor	T	= transformer		
DL	= delay line	M	= meter	TB	= terminal board		
DS	= device signaling (lamp)	MP	= mechanical part	TP	= test point		

ABBREVIATIONS

A	= amperes	GRD	= ground (ed)	NFR	= not field replaceable	HH	= roundhead
BE CU	= beryllium copper	H	= henries	NI PL	= nickel plate	RMO	= rack mount only
BH	= binder head	HEX	= hexagonal	NO	= normally open	RMS	= root mean square
BP	= bandpass	HR	= hour (s)	NPO	= negative positive zero (zero temperature coefficient)	S-B	= slow-blow
BRS	= brass	IF	= intermediate freq			SCR	= screw
CCW	= counterclockwise	IMPG	= impregnated	NRFR	= not recommended for field replacement	SE	= selenium
CER	= ceramic	INCD	= incandescent			SECT	= section (s)
CMO	= cabinet mount only	INCL	= include (s)			SI	= silicon
COEF	= coefficient	INS	= insulation (ed)	OBD	= order by description	SIL	= silver
COM	= common	INT	= internal	OV HD	= oval head	SL	= slide
COMP	= composition	K	= kilo = 1000	OX	= oxide	SPL	= special
CONN	= connector	LIN	= linear taper	P	= peak	SST	= stainless steel
CP	= cadmium plate	LKWASH	= lockwasher	PAN HD	= pan head	SR	= split ring
CW	= clockwise	LOG	= logarithmic taper	PC	= printed circuit	STL	= steel
DEPC	= deposited carbon	LPF	= low pass filter	PF	= picofarads = 10 ⁻¹² farads	TA	= tantalum
DR	= drive	M	= milli = 10 ⁻³	PH BRZ	= phosphor bronze	TD	= time delay
ELECT	= electrolytic	MEG	= meg = 10 ⁶	PHL	= Phillips	TGL	= toggle
ENCAP	= encapsulated	MET FLM	= metal film	P/V	= peak inverse voltage	TI	= titanium
EXT	= external	MET OX	= metallic oxide	P/O	= part of	TOL	= tolerance
FBR	= fiber	MFR	= manufacturer	POLY	= polystyrene	TREM	= trimmer
FDTHRU	= feedthru	MINAT	= miniature	PORC	= porcelain	μ	= micro = 10 ⁻⁶
FET	= field effect transistor	MOM	= momentary	POS	= position (s)	VAR	= variable
FH	= flat head	MTG	= mounting	POT	= potentiometer	VDCW	= dc working volts
FIL HD	= fillister head	MY	= "mylar"	PT	= peak-to-peak	W/	= with
FXD	= fixed	NC	= normally closed	PP	= point	W	= watts
Ge	= germanium	NE	= neon	PWV	= peak working voltage	WW	= wirewound
GL	= glass	nF	= nanofarad (= 1000 pF)	PZ	= "pozidrive"	W/O	= without

TABLE 6-1. REFERENCE DESIGNATOR INDEX

Reference Designation	Stock Number	Description
AT100	03200-60011	Attenuator probe. Includes L107 and J100
C101	03200-00005	Trimmer minimum "C"
C102	0160-0434	C: fxd cer 10 pF 0.1 pF 500 vdcw
C103	5080-1719	C: var 31.5 pF 700 V calibrated
C104	0160-0434	C: fxd cer 10 pF 0.1 pF 500 vdcw
C105	03200-00005	Trimmer minimum "C"
C106	0160-0919	C: fxd cer 10 pF 10% 150 vdcw
C107	0160-0919	C: fxd cer 10 pF 10% 150 vdcw
C108	0132-0002	C: var poly 0.7 - 3pF
C109, 110	0160-0480	C: fxd cer 1000 pF -20 + 80% 500 vdcw
C111	0160-0415	C: fxd cer 100 pF 10% 500 vdcw
C112, 113	0160-0345	C: fxd cer 1000 pF -20 + 80% 500 vdcw
C114	0160-2162	C: fxd cer 100 pF 20% 500 vdcw
C116	0160-0952	C: fxd mica 220 pF 1%
C117		Not replaceable. P/O 03200-60024
C119-121		For Ref. only. See schematic notes Table 7-1
C122	0160-2163	C: fxd paper 0.47 μ F 20% 100 vdcw
C201	0160-0492	C: fxd my 1.0 μ F 20% 200 vdcw
C300	0180-1748	C: fxd alum 45 μ F 250 vdcw
C301	0170-0040	C: fxd my 0.047 μ F 10% 200 vdcw
C302	0180-1796	C: fxd alum 40 μ F -10 + 50% 150 vdcw
C303	0180-0345	C: fxd alum 2000 μ F 25 vdcw
C304	0170-0024	C: fxd my 0.022 μ F 20% 200 vdcw
C305	0140-0054	C: fxd mica 100 pF 10% 500 vdcw
C401	0160-2006	C: fxd mica 100 pF 10% 500 vdcw
CR300, 301	1901-0029	Diode Si 600 piv 0.75 A
CR302-305	1901-0049	Diode Si 50 piv 0.75 A
CR306	1902-0186	Diode brkdwn 32.4 V 400 mW
CR401-3	1901-0049	Diode Si 50 piv 0.75 A
DS200	1450-0048	Light, indicator, power on
F200	2110-0008	Fuse 125 V 0.5 A SLO-BLO (115 V operation)
F200	2110-0018	Fuse 125 V 0.25 A SLO-BLO (230 V operation)
F201	2110-0040	Fuse 125 V 0.062 A SLO-BLO
J100		Not replaceable. P/O AT100
J200	1251-0043	Connector female 8 contacts
J201-202	1250-0001	Connector RF OSM type 2 hole flange
L101-106		For Ref. only. P/O Z100
L107		For Ref. only. P/O AT100
L108		For Ref. only. Lead inductance NSR
L109-110	03200-80002	Choke 80 μ H
L112	03200-80002	Choke 80 μ H
L113	03200-80001	Choke 17 μ H
L114-115	00225-80001	Coil Assy 410 μ H
L116	03200-80022	Coil Assy RF 140 μ H
P200	1251-0133	Connector male 8 contacts
P204	1251-0148	Connector AC power 3 pin

TABLE 6-1. REFERENCE DESIGNATION INDEX (CONT)

Reference Designation	Stock Number	Description
Q300	1850-0098	Transistor PNP Ge 2N458
Q301, 302	1853-0016	Transistor PNP Si 2N3638
Q303	1850-0098	Transistor PNP Ge 2N458
Q401	1853-0036	Transistor PNP Si 2N3906
R101-106	0686-1015	R: fxd comp 100 Ω 5% 1/2 w
R107, 108	0686-2235	R: fxd comp 22 K Ω 5% 1/2 w
R109	0683-3315	R: fxd comp 330 Ω 5% 1/2 w
R110-112	0683-1015	R: fxd comp 100 Ω 5% 1/2 w
R113	0686-2205	R: fxd comp 22 Ω 5% 1/2 w
R114	0683-1015	R: fxd comp 100 Ω 5% 1/2 w
R118	0758-0002	R: fxd met flm 560 Ω 5% 1/2 w
R119	0686-2205	R: fxd comp 22 Ω 5% 1/2 w
R201	0686-6835	R: fxd comp 68 K Ω 5% 1/2 w
R202	0698-3635	R: fxd met ox 680 Ω 5% 2 w
R203	2100-1461	R: comp lin 1 K Ω 10% 2.25 w Includes S200
R204	0698-3631	R: fxd met ox 330 Ω 5% 2 w
R205	0686-5125	R: fxd comp 5.1 K Ω 5% 1/2 w
R300	0686-1015	R: fxd comp 100 Ω 5% 1/2 w
R301	0686-7535	R: fxd comp 75 K Ω 5% 1/2 w
R302	0698-0030	R: fxd met ox 510 Ω 10% 2 w
R303	0686-6815	R: fxd comp 680 Ω 5% 1/2 w
R304	0686-4725	R: fxd comp 4.7 K Ω 5% 1/2 w
R305	0686-1825	R: fxd comp 1.8 K Ω 5% 1/2 w
R306	2100-0801	R: var lin 2 K Ω 10% 0.15 w
R307	0686-3315	R: fxd comp 330 Ω 5% 1/2 w
R308	0686-6825	R: fxd comp 6.8 K Ω 5% 1/2 w
R309	0686-1215	R: fxd comp 120 Ω 5% 1/2 w
R310	0761-0070	R: fxd met ox 8.2 K Ω 5% 1 w
R401	0758-0098	R: fxd met ox 220 K Ω 5% 1/2 w
R402, 403	0758-0003	R: fxd met flm 1 K Ω 5% 1/2 w
S101	03200-00010	Contact, grid switch
S200	2100-1461	Switch, POWER OFF, Includes R203
S201	3101-0033	Switch, slide DPDT
S202	3101-0192	Switch, slide DP 3 pos
T200	9100-0314	Transformer, power
V100, 101	1921-0034	Tube, elect EIA 6DZ4
V300	1940-0004	Tube, elect OA2
W200	8120-0078	Cable Assy
XF200, 201	1400-0084	Fuseholder 3 AG fuse extractor post type
XQ300	1200-0044	Socket, transistor
XQ303	1200-0044	Socket, transistor
XV100, 101	03200-80010	Socket, tube, modified NRFR
XV300	1200-0053	Socket, tube, 7 pin min
Z100	03200-60004	Turret Assy Includes L101 - L106
Z300	03200-60001	PC Board, Pulse Mod
Z400	03200-60027	PC Board, Grid Switch

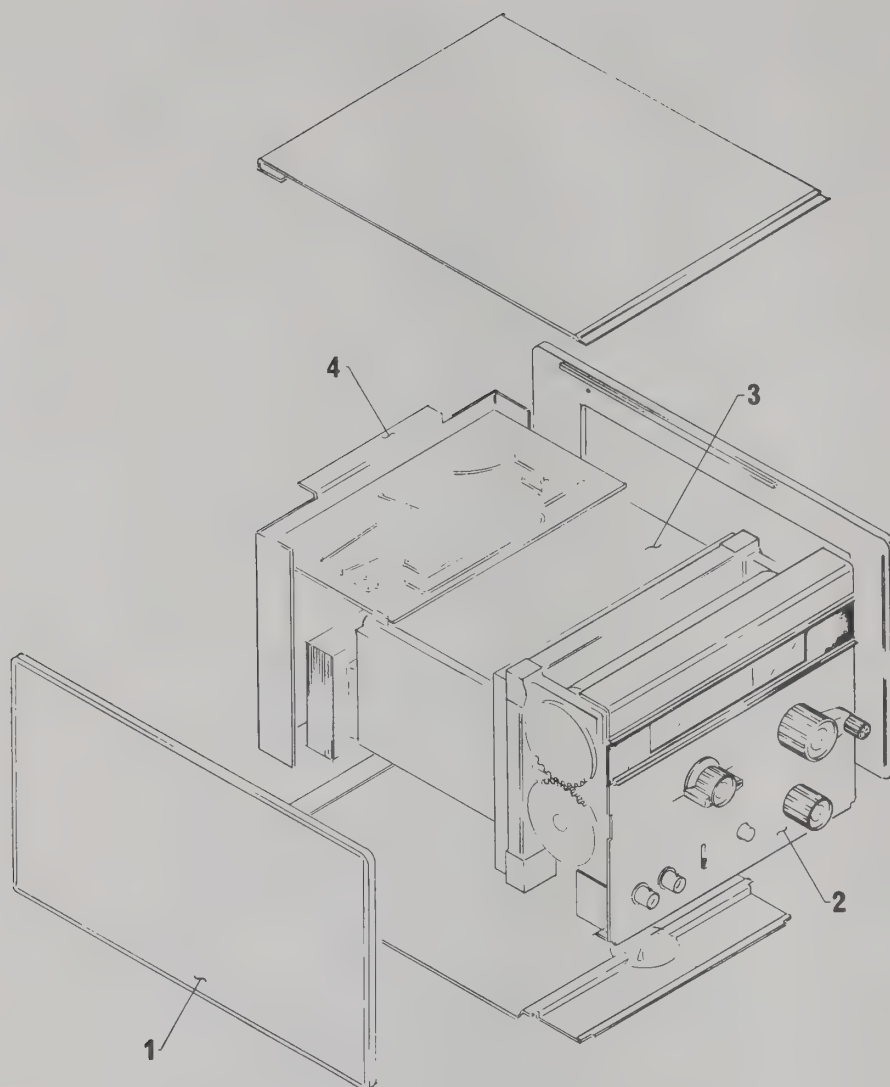


Figure 6-1. -hp- 3200B VHF Oscillator, General Arrangement

Ref	Illustrations
1	See Page 6-5, Cabinet Parts
2	See Pages 6-6 and 6-7, Front Section and Panel Assembly
3	See Pages 6-8 and 6-9, RF Oscillator Compartment
4	See Pages 6-10 and 6-11, Rear Section and RF Compartment Cover

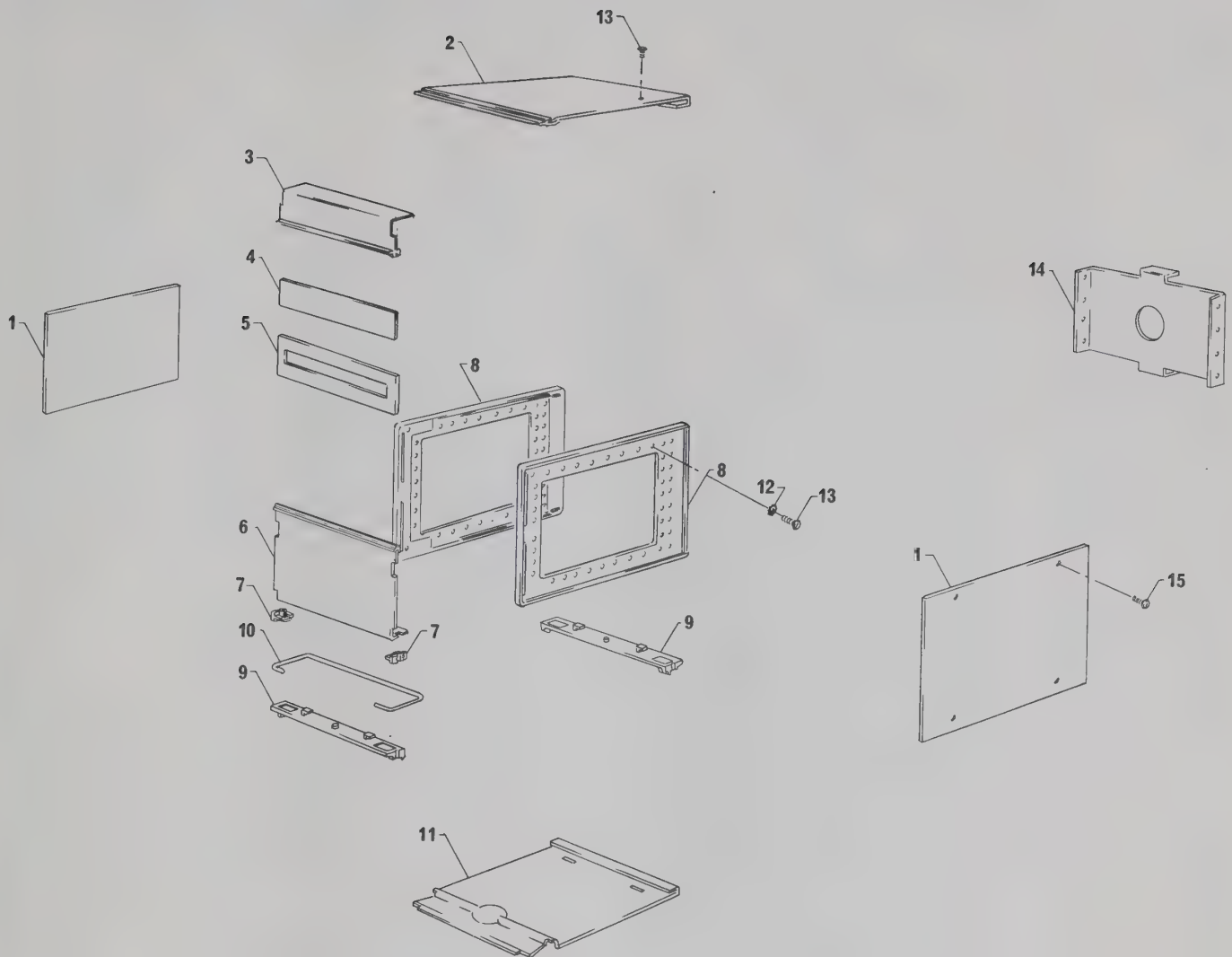


Figure 6-2. -hp- 3200B VHF Oscillator, Cabinet Parts

Ref	Part No.	Description	Qty
1	5000-0703	Side cover	2
2	5060-0720	Top cover	1
3	03200-00021	Upper front panel	1
4	03200-20014	Front panel window	1
5	03200-80016	Window mask	1
6	03200-00027	Lower front panel	1
7	5040-0700	Hinge	2
8	5060-0703	Side frame assy	2
9	5060-0728	Foot assy	2
10	1490-0032	Tilt stand	1
11	5000-0717	Bottom cover	1
12	2190-0047	Conical Lockwasher, EXT, #6	12
13	2370-0016	Machine screw, 6-32 x 5/16 FH	16
14	03200-00022	Rear panel	1
15	2370-0020	Machine screw, 6-32 x 3/16 FH	8

Ref.	Stock No.	Description	Qty
1	03200-20025	Spur gear	2
2	0510-0294	Spring pin, 1/16 D x 11/16 L, STL	3
3	03200-20007	Counter shaft	1
4	03200-60014	Counter shaft assembly (includes Ref. 1, 2, 3)	8
5	2295-0006	Machine screw, BH, 4-40 x 1/4, BRS, SD	8
	2190-0004	Lockwasher, INT #4	8
6	03200-60019	Pulley and bracket assy	1
7	03200-20040	Base plate	1
8	3030-0117	Setscrew, CUP PT, 8-32 x 1/4	1
9	03200-20030	Frequency drum dial	1
10	03200-20013	Dial shaft	1
	03200-60015	Dial shaft assembly (includes Ref. 1, 2, 10)	1
11	3050-0316	Spring washer, 13/16 OD	2
12	3050-0274	Flatwasher, 3/4 OD, BRS	2
13	0510-0235	Retaining ring, for 3/8 shaft	1
14	0590-0111	Push-on nut, 1/2 OD, STL	4
15	03200-20008	Cursor guide rod	2
16	03200-20041	Frequency shaft	1
17	0360-0270	Solder Lug #10	1
18	2700-0015	Machine screw, 10-32 x 5/8	1
19	3030-0033	Setscrew, CUP PT, 6-32 x 3/16	1
20	1500-0044	Frequency shaft vernier drive	1
21	03200-20011	Turret shaft, fiber glass	1
22	0510-0296	Roll pin, detent wheel	1
23	5040-1601	Detent wheel	1
24	03200-20026	Miter gear: turret shaft	1
	03200-60013	Turret shaft assembly, (includes Ref. 21, 22, 23, 24)	1
25	03200-60018	Pulley and bracket assy	3
26	0360-0393	Standoff, 1 lug	1
27	2470-0001	Machine screw, BH 6-32 x 1/4, BRS, SD	2
28	2190-0008	Lockwasher, EXT #6	1
29	03200-80014	Cursor stop	1
30	03200-00011	Cursor	1
31	00230-20065	Detent roller	1
32	5000-3001	Detent spring	1
33	606A-91B	Leaf spring	1
34	2190-0010	Lockwasher, EXT #8	3
35	2550-0006	Machine screw, BH, 8-32 x 3/8, SST, SD	1
Ref.	Stock No.	Description	Qty
36	03200-20027	Miter gear: counter shaft	1
37	0510-0717	Cable clamp, flattened loop	1
38	3050-0066	Flatwasher, 3/8 OD, BRS	1
39Δ	03200-20042	Frequency & range shaft plate assy	1
40	2510-0031	Machine screw, PAN HD, 8-32 x 1/2, SST, SD	2
41	2950-0001	Hex nut, 3/8 - 32 x 1/2	1
42	03200-00025	Switch plate	1
43	2190-0016	Lockwasher, INT 1/2 OD, 3/8 ID, PH BRZ	1
44	0510-0123	Push-on fastener for 5/16 std	1
45	2100-1461	R: var, comp, 1KΩ (R203)	1
46	0360-0380	Solder terminal, .398 hole x 1-33/64 L, BRZ	1
47	03200-00023	Upper panel support	1
48	03200-00021	Upper front panel	1
49	03200-20014	Front panel window	1
50	03200-80016	Window mask	1
51	03200-00027	Lower front panel	1
52	1490-0032	Tilt stand, 7.088 L x 2.236 H	1
53	5040-0700	Hinge	2
54	3101-0192	Slide switch, DP3 POS (S202)	1
55	1250-0211	Connector: BNC panel mtg (J201, 202)	2
56	1450-0048	Indicator light, red, (DS202)	1
57	0370-0112	Skirted bar knob, 3/4 D, 1/4 shaft	1
58	3030-0117	Setscrew, CUP PT, 8-32 x 1/4	6
59	0370-0026	Round knob, 3/4 D, 1/4 shaft, w/arrow	1
60	0370-0149	Knob and crank assy	1
61	0370-0111	Crank knob, 1 D, 1/4 shaft	1
62	1410-0033	Knob bushing, .219 OD	1
63	0370-0050	Round knob, 3/8 OD x .525 L	1
64	2410-0001	Machine screw, OH, 6-32 x 5/8, SST	1
65	3050-0272	Bowed washer	1
66	2370-0016	Machine screw, FH100°, 6-32 x 5/16, SST	1
67	2190-0047	Lockwasher, conical, EXT #6	1
Δ Changed on s/n 708-01101 and above. Units with s/n 626-0110 and below should use new plate assy as a replacement, though it may become necessary to shim the plate assy with the base plate using flat washers			

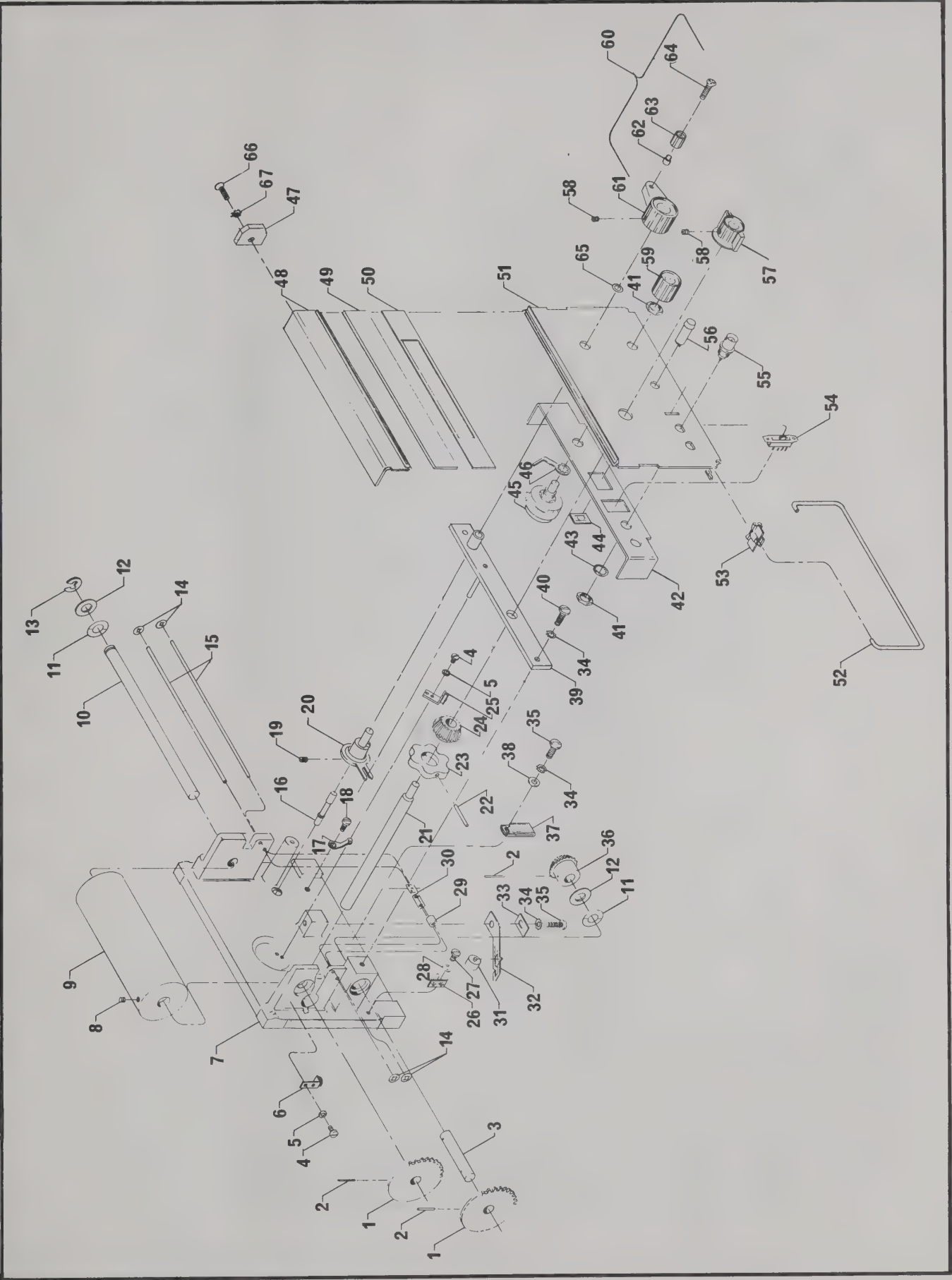


Figure 6-3. -hp- 3200B VHF Oscillator, Front Section and Panel Assembly

Ref.	Stock No.	Description	Qty
1	03200-20001	Base plate-casting	1
2	2190-0088	Lockwasher (p/o 8)	1
3	2950-0027	Hex nut, 5/16-32 x 7/16 CP, BRS (p/o 8)	1
4	2732-0008	Machine screw, BHD, 10-32 x 3/4, SST, PHD	2
5	2190-0012	Lockwasher, EXT, # 10	2
6	0360-0270	Solder lug, PH BRZ, INT, # 10	2
7	2700-0009	Machine screw, PANHD, 10-32 x 1-1/2, SD	2
8	0160-2163	C: fxd, paper, .47 μ F, $\pm 20\%$, 100 vdcw, (C122)	1
9	03200-20022	Spacer long tube shelf	2
10	03200-20023	Spacer short tube shelf	2
11	3050-0316	Spring washer, .396 ID, 3/16 OD, BE CU	1
12	3050-0274	Flatwasher, BRS, 3/4 OD	1
13	0610-0002	Hex nut, 2-56 x 3/16 x 1/16, BRS	3
14	2190-0014	Lockwasher, INT, # 2	3
15	0340-0098	Standoff terminal, .475 LG. TEFLON [®]	1
16	0510-0060	Grip ring, for 3/8 shaft	1
17	0360-0390	Solder lug, non-locking, # 2 BRS	3
18	2270-0019	Machine screw, PANHD, 4-40 x 5/16, SST	2
19	2190-0004	Lockwasher, INT, # 4	2
20	5080-1719	C: var, 3.5 to 31.5 pF (C103A, B)	1
21	0360-0037	Solder lug, ring type, CPR	3
22	2470-0013	Machine screw, BH, 6-32 x 3/8, BRS, SD	2
23	0360-0383	Solder lug, # 6	1
24	2190-0007	Lockwasher INT, # 6	1
25*	03200-20021	Grid switch insulator, NR FR, p/o Ref. 53	2
26	2470-0013	Machine screw, BH, 6-32 x 3/8, BRS, SD	2
27	2360-0002	Machine screw, RH, 6-32 x 3/16, SST	1
28	03200-60024	Pulley assembly	1
29	3030-0117	Setscrew, CUP PT, 8-32 x 1/4	1
30	03200-00004	Shield can, BOT	1
31	0160-0480	C: fxd, cer, 1000 pF, 500 vdcw (C109, 110)	2
32	3050-0341	Fiber washer 3/16 ID	4
33	0890-0294	Sleeving, transflex	1-1/8
34	00225-80001	Coil, RF choke, (L114, L115, L116)	3
35	03200-00024	Shield can, TOP	1
Ref.	Stock No.	Description	Qty
		NOT SHOWN	
	8200-0049	Dial cord	4'
	1460-0154	Dial cord spring	1
	5040-0147	Insulator	1
36	2820-0001	Hex nut, 10-32 x 3/8, BRS	1
37	0160-0345	C: fxd, cer, 1000 pF, 500 vdcw (C112, C113)	1
38	2500-0005	Hex nut, 6-32 x 1/4 x 7/64, BRS	2
39	2190-0018	Lockwasher, split, # 6	4
40			4
41	03200-60027	Printed board assy, pulse mod (Z400)	1
42	0132-0002	C: var, POLY, 0.7 - 3 pF (C108)	1
43	2732-0005	Machine screw, BH, 10-32 x 3/8, SST, SD	2
44	0360-0458	Solder lug, non-locking, # 2, CPR	2
45	0520-0039	Machine screw, BH, 2-56 x 1/8, BRS, SD	1
46	03200-80010	Tube socket, NFR, p/o Ref. 53	3
47	0340-0105	Feedthru, INS, 0.515 LG	2
48	03200-00010	Grid switch contact, (p/o S101)	2
49	0360-0446	Standoff terminal, press-in, .350 LG (p/o S101)	2
50	2680-0026	Nylon screw, BH, 10-32 x 3/4, SD	2
51	2190-0012	Lockwasher, EXT, # 10	2
52	03200-20016	Spacer TEFLON [®]	2
53	03200-60003	RF Tube shelf assembly, w/components	2
54+	03200-00017	Right contact (near pulley)	1
	03200-00018	Left contact	1
55+	03200-80035	Lockwasher, helical, PH BRZ, # 2, SP	2
56+	00225-80007	Hex nut, 2-56 x 1/8 x 3/64, BRS, SP	2
57	2190-0110	Fiber washer, # 8	2
58	03200-00019	Spring contact	1
59	2190-0130	Shoulder washer, nylon	2
60	3050-0098	Flatwasher, # 2	2
61	0520-0052	Machine screw, BH, 2-56 x 3/8, BRS, SD	2
62	3030-0002	Setscrew, 8-32 x 3/8, SKT HD	2
63	9170-0123	Ferrite slug, THD (p/o 64) (p/o L101-104)	4
64	03200-60004	Turret assy	
	1530-0061	Insert, INT THD, phenolic paper (p/o 64)	4
+ on some instruments these contacts are soldered which eliminates Ref. 55 and 56			
* Not used in serials prefixed 708 and after			

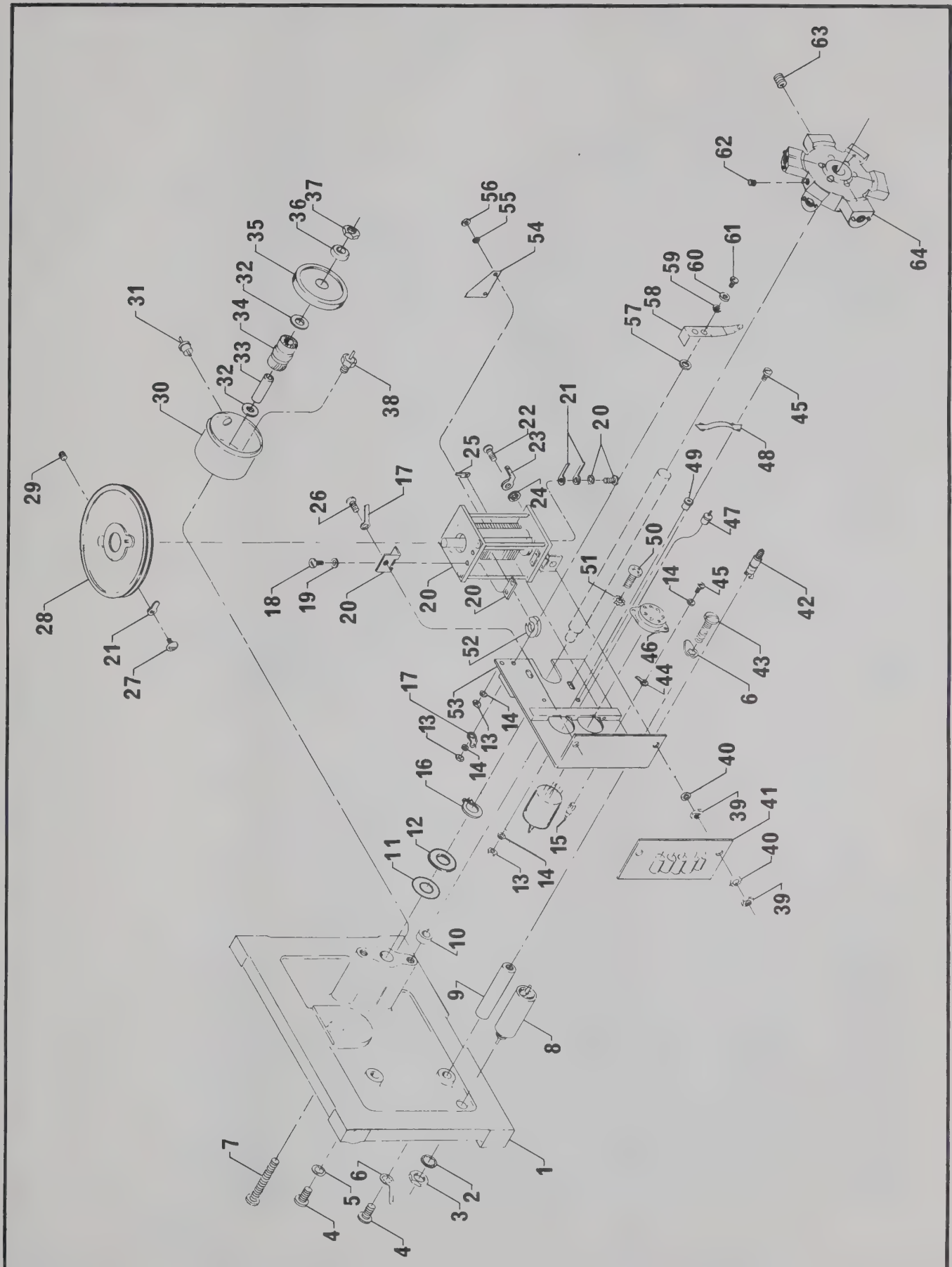


Figure 6-4. -hp- 3200B VHF Oscillator, RF Oscillator Compartment

Ref	Stock No.	Description	Qty
31	1200-0043	Mounting insulator	2
32	1850-0098	Transistor, Ge, PNP	2
33	2270-0025	Machine screw, 4-40 x 1/2 SST	4
34	3101-0033	Slide switch, DPD T (S201)	1
35	1251-0148	Power connector, (P204)	1
36	1460-0225	Spring, attenuator locking	1
37	03200-80012	Retaining ring: attenuator pin	1
38	03200-20019	Pin attenuator locking	1
39	2190-0084	Lockwasher, INT, SST	4
40	2440-0011	Machine screw, RH, 6-32 x 3/8, BRS, SD	4
41	8160-0021	Brace, RF 1/8 D, BRS 21"	1
42	00225-20015	Threaded plug, silver plated	1
43#	03200-60030	Shield cover	1
44	2732-0008	Machine screw, BH, 10-32 x 5/8, PHD, SST	4
45	2190-0091	Lockwasher, helical, #10, PH BRS	4
46+	03200-20043	Attenuator collar	1
47+	3030-0001	Setscrew, CUP PT, 8-32 x 3/16	2
48+	8150-0748	Attenuator gasket	1
49*	03200-20018	Tube, outer attenuator	1
50*	03200-20003	Shield cover	1
51*	3030-0117	Setscrew, CUP PT, 8-32 x 1/4	1
52*	8150-0748	Attenuator gasket	1
53*	03200-00009	Attenuator gasket washer	1
54*	0590-0107	Retaining nut, attenuator	1
		Δ changed on s/n 708-01101 and above	
		# changed on s/n 551-00451 and above	
		+ used on s/n 451-00494 and below	
		* used on s/n 451-00450 and below	

Ref	Stock No.	Description	Qty
1	03200-20009	Attenuator locking collar	1
2	03200-60011	Attenuator probe (AT100)	1
3	1400-0084	Fuseholder, (includes 4, 15, 16)	2
4	4100-0090	Flatwasher neoprene, 1/2 ID	2
5	2390-0025	Machine screw, BH, 6-32 x 1", SST, SD	2
6	2390-0051	Machine screw, BH, 6-32 x 1-1/8, SST, SD	3
7	0510-0221	Retainer nut, 6-32	6
8	0590-0010	Cap nut, 8-32	4
9	2190-0009	Lockwasher, INT, #8	4
10	2470-0001	Machine screw, BH, 6-32 x 1/4, BRS, SD	1
11	2190-0007	Lockwasher, INT, #6	6
12	03200-00022	Rear panel	1
13	0380-0145	Spacer, 3/8 OD x 3/4 LG. ALUM	4
14	9100-0314	Power transformer	1
15	2190-0031	Lockwasher, INT, .529 ID	2
16	2950-0038	Hex nut 1/2-24 x 11/16	2
17	00202-20034	Spacer, sleeve, 3/4 LG	2
18	1251-0043	Female connector, 8 contact (J200)	1
19	2500-0005	Hex nut, 6-32 x 1/4 x 7/64, BRS	5
20	0360-0365	Solder terminal, INT, #6	1
21	1251-0133	Male connector, 8 contact (P200)	1
22	03200-60001	PC board w/components & bracket (to replace XQ300 or XQ303 refer to detail of bracket for serials prefixed 708-01101 and above)	1
23	0624-0077	Machine screw, 4-40 x 3/8 Pozzi Pan HD, SST	2
24	2190-0086	Lockwasher, split #4	6
25	3050-0105	Flatwasher #4	8
26	2260-0008	Hex nut, 4-40 x 3/16 x 1/4, SST	4
27	1200-0081	Insulator bushing	4
28	0360-0383	Solder terminal	2
29	1200-0044	Transistor socket	2
30Δ	03200-00006	Heat sink bracket	1

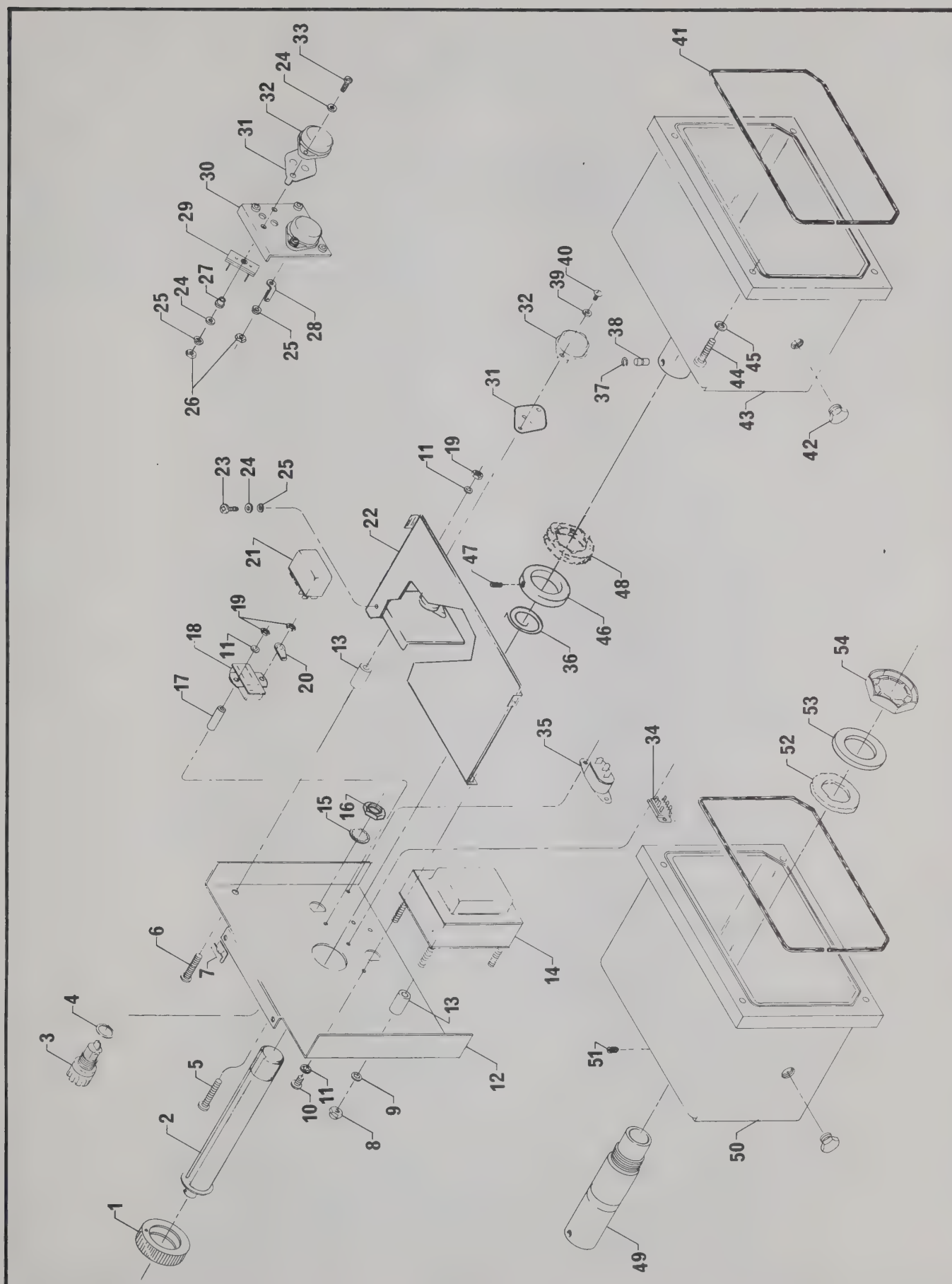


Figure 6-5. -hp- 3200B VHF Oscillator, Rear Section and RF Compartment Cover

INSTRUMENT CHANGE HISTORY

This Manual applies directly to Model 3200B VHF Oscillators having serial prefix 735. To apply this Manual to serial prefixes 534, 604, 622, 626, 708, and 731, refer to the numbered notes below which describe the differences between instruments. Changes are also recommended to update the instrument.

<u>Serials prefixed</u>	<u>See notes numbered:</u>
731	1, 2, 3, 12
708	1, 2, 3, 4, 12
626	2 thru 7, 12
622	1 thru 5, 7 thru 9, 12, 13
604, 534	1 thru 5, 7 thru 14

1. R305 was 0686-2725. R: fxd, comp, 2.7 K ohms, 5%, 1/2 w.
2. R306 was 2100-0154. R: var, 1 K ohm, 30%, 0.15 w.
3. Q303 was 1850-0038. Transistor, Ge, 2N3906, PNP. If replacement is necessary, use the part number given in Table 6-1 of this Manual.
4. Flange Bearing Plate configuration was changed. (Item 39 of Figure 6-3). As replacement use the number given in Figure 6-3. Use of washers as shims may be necessary to prevent frequency shaft from rubbing base plate.
5. A fabricated Grid Switch Insulator was used. (Item 25 of Figure 6-4). If replacement is necessary use Teflon sleeving.
6. R305 was 0686-2225. R: fxd, comp, 2.2 K ohm, 5%, 1/2 w.
7. Bowed Washer was not used (Item 65 of Figure 6-3). Addition of this part is recommended to prevent the movement of frequency tuning shaft from weight of knob.
8. Q301 was 1850-0070. Transistor, Ge, 2N1373, PNP.
9. Q303 was 1850-0062. Transistor, Ge, 2N404, PNP.
10. Q401 was 1850-0070. Transistor, Ge, 2N1373, PNP.
11. R205 was 0758-0006. R: fxd, met ox, 10 K ohm, 5%, 1/2 w.
12. If replacement of either R305 or R306 is necessary, replace both with the values given in Table 6-1 of this Manual.
13. If replacement of either Q301 or Q302 is necessary, replace both with the part numbers given in Table 6-1 of this Manual.
14. Specification for External Pulse Modulation for these instruments was: 1 Volt negative pulse into 2000 ohms. Replacement of both Q401 and R205 with the part numbers given in Table 6-1 of this manual is recommended to improve Pulse Modulation operation at high ambient temperatures. Note that this change also changes the External Pulse Modulation input specification to that given in Table 1-1 of this Manual.

SECTION VII SCHEMATIC DIAGRAMS

7-1. INTRODUCTION

7-2. This section includes manual backdating changes, the schematic diagram and component identification illustrations. Table 7-1 contains the notational information for the schematic diagram of Figure 7-1. The DC voltages drawn on the sche-

matic are typical voltages and are not to be construed as specifications. They were measured with an -hp- 410B Voltmeter.

7-3. For location and identification of mechanical components, refer to Figures 6-1 through 6-5.


TABLE 7-1. SCHEMATIC DIAGRAM NOTES

- 1 Resistance is in ohms, capacitance in picofarads and inductance in microhenries unless otherwise specified.
- 2 S101 is operated by cam on turret; contacts close on 10-18.8 MHz and 18.5-35 MHz ranges only.
- 3 Grid voltage varies with frequency -9 to -25 Vdc.
- 4 S200 is part of R203.
- 5 Use 1/2 amp. SLO BLO fuse for 115 V operation and 1/4 amp. SLO BLO fuse for 230 V operation.
- 6 Due to the interlock feature of V300 (OA2), the Power Supply will not operate with this tube removed from its socket.
- 7 The following capacitors are special and the values are not critical:

Ref. Sym.	Description
C117	Capacitance between ring on pulley and base plate
C119	Capacitance between resistor leads and Rotor Shaft
C120	Capacitance across Rotor thrust bearing
C121	Capacitance between C103 tie rod and C103 Rotor


- 8 Z100 Inductor vs. Range:

L101	10-18.8 MHz
L102	18.5-35 MHz
L103	35-68 MHz
L104	68-130 MHz
L105	130-260 MHz
L106	260-500 MHz

- 9  Color code of wires using RETMA standard colors vs. numbers, e.g., 6-0-2: Blue-Black-Red

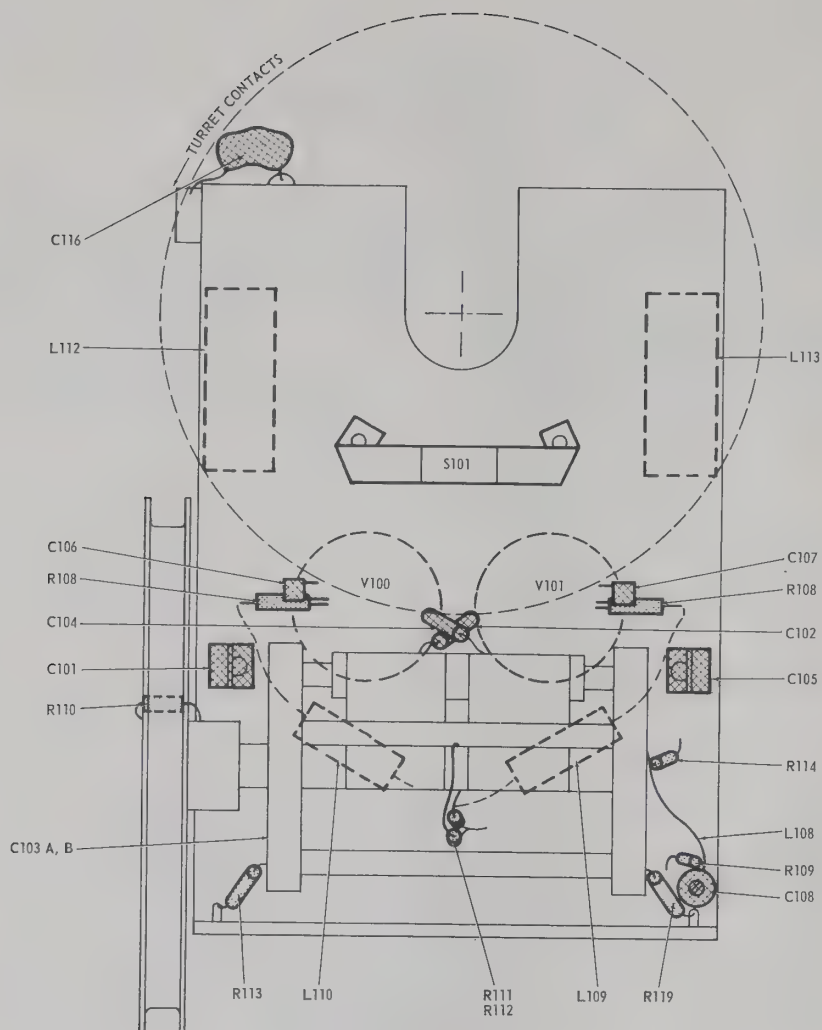
- 10  Front Panel Designation

- 11  Rear Panel Designation

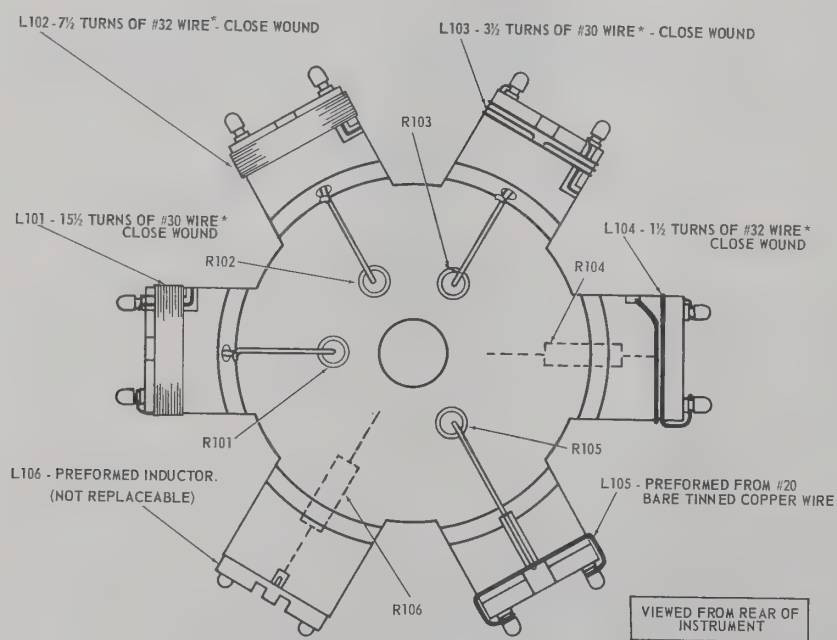
- 12  Knob Control

- 13  Screwdriver Adjustment

- 14  Wiper moves toward CW when control is rotated clockwise



RF TUBE SHELF



Z100

* SINGLE POLYURETHANE COVERED

RF TURRET ASSEMBLY

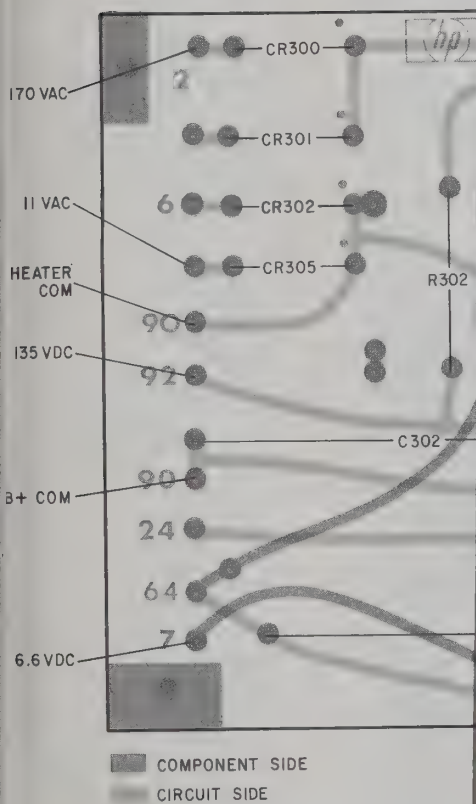
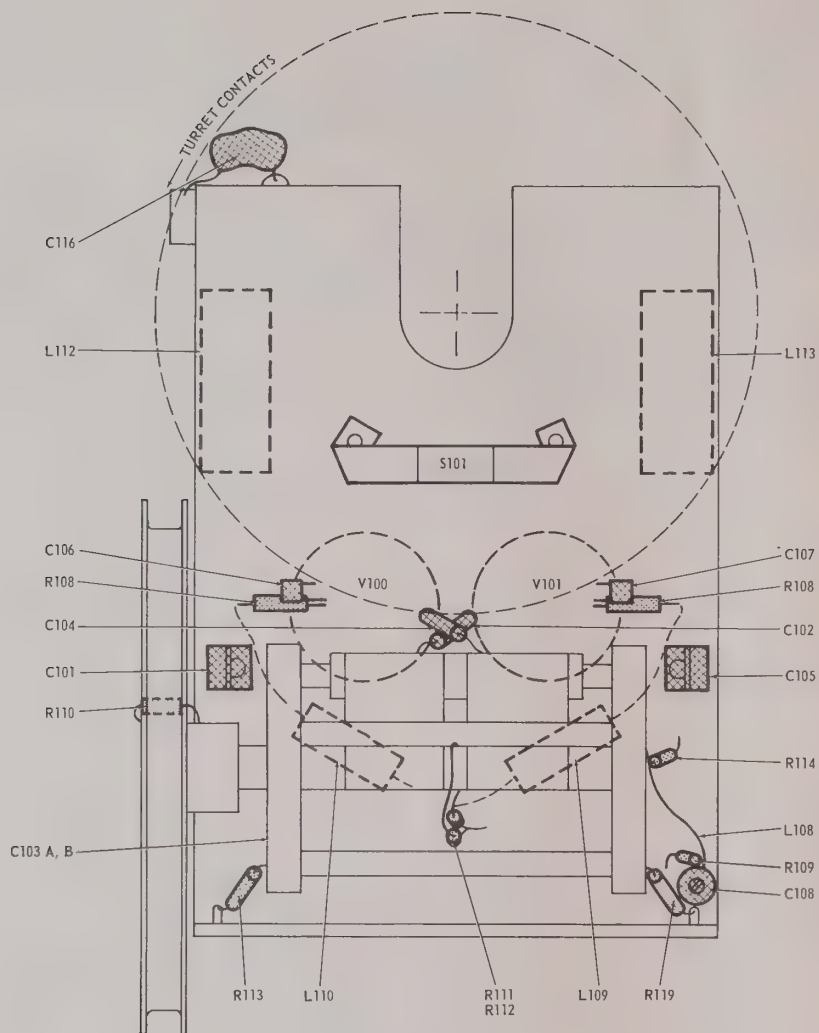
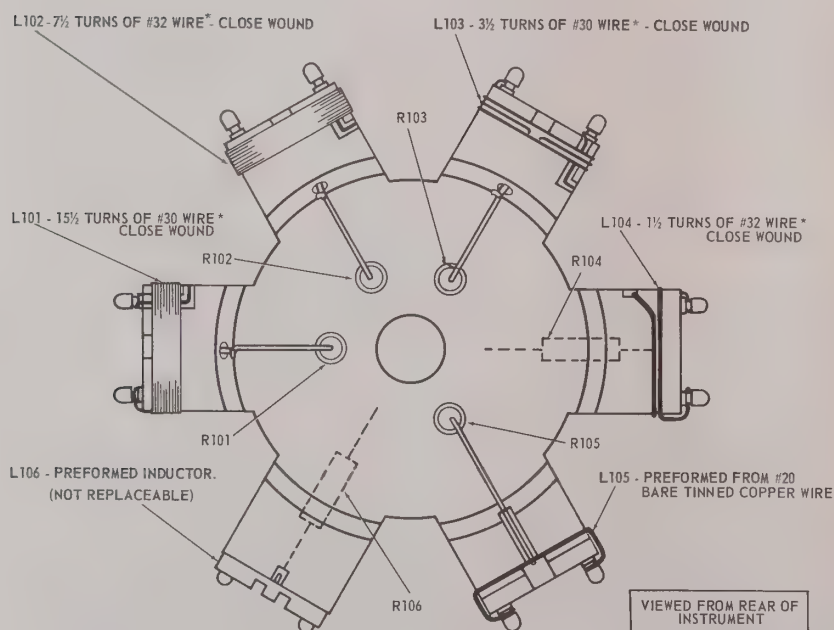


Figure 7-1
SCHEMATIC DIAGRAM



RF TUBE SHELF



Z100

* SINGLE POLYURETHANE COVERED

RF TURRET ASSEMBLY

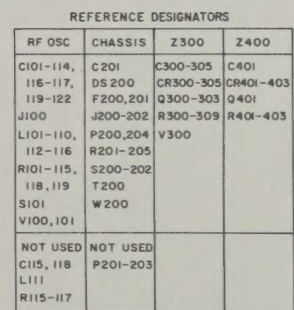
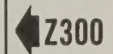
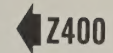


Figure 7-1
SCHEMATIC DIAGRAM



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